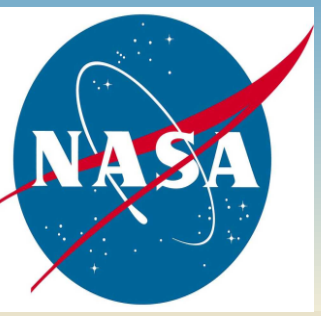
Decision and Information System for the Coastal waters of Oman (DISCO)

An integrative tool for managing coastal resources under changing climate

Joaquim I. Goes

Lamont –Doherty Earth Observatory at Columbia University,
Palisades, New York, USA



Helga do Rosario Gomes
Lamont –Doherty Earth Observatory, New York, USA

Dale Kiefer
System Sciences Application Inc. Los Angeles, USA

Sergio deRada
Naval Research Laboratory, Mississippi, USA

Huijie Xue
University of Maine, Orono, USA

Khalid Al-Hashmi
Sultan Qaboos University, Muscat, Oman

Adnan Al-Azri
Ministry of Foreign Affairs. Sultanate of Oman, Oman

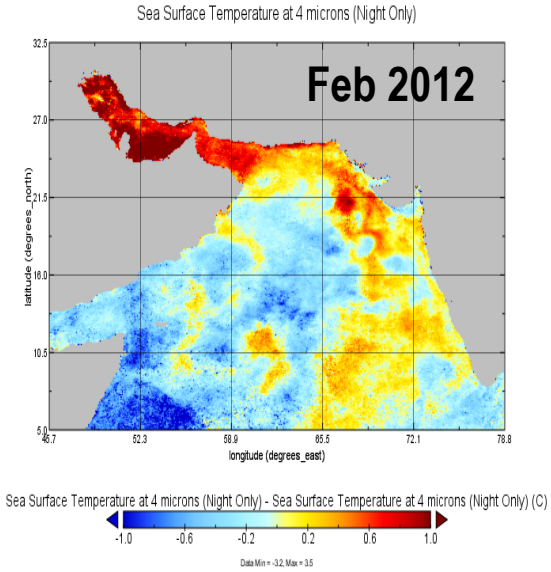
Lubna Al-Kharusi
Ministry of Agriculture and Fisheries Wealth
Sultanate of Oman Muscat, Oman

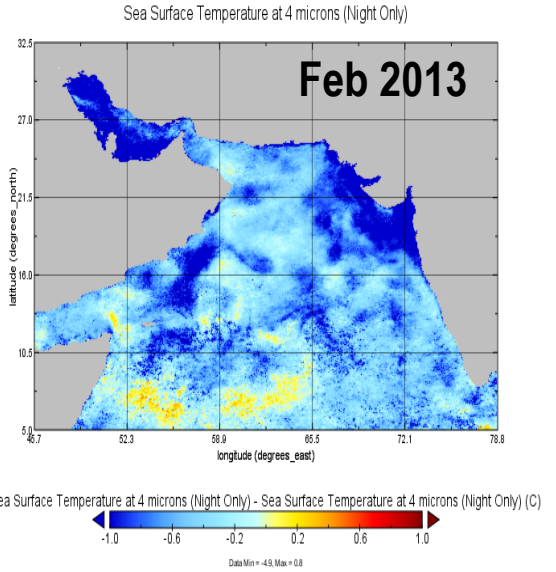
MAP OF THE ARABIAN SEA SHOWING OMAN

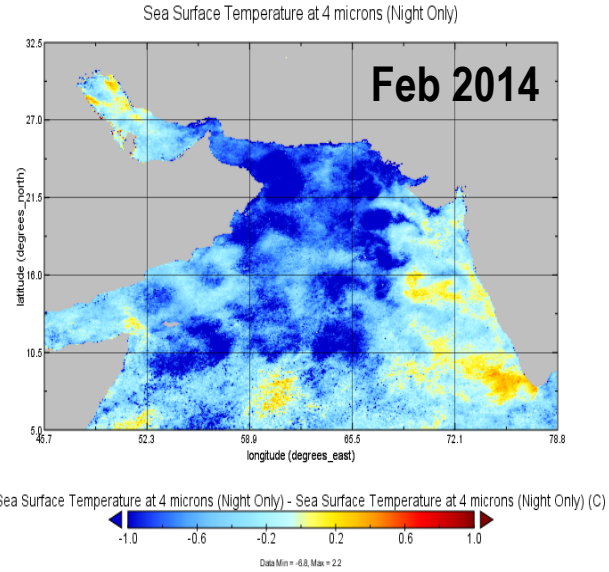
Total area – 309,500 km^2, Population - 4.5M

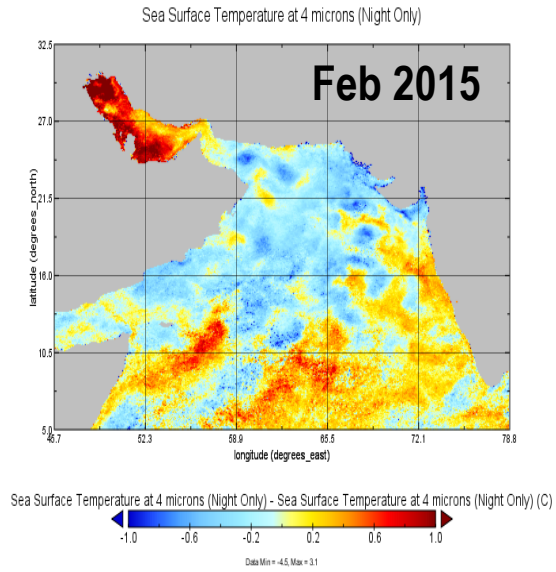
Coastline – ~2000km^2, Gateway to the Persian Gulf

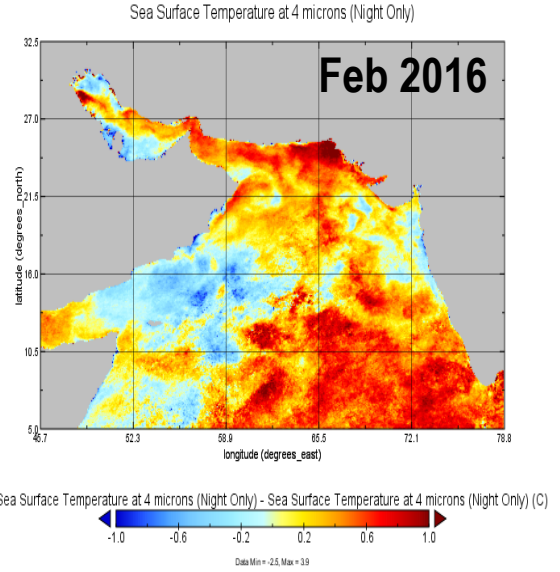
Economy – Oil, agriculture, fish, tourism and coastal industries

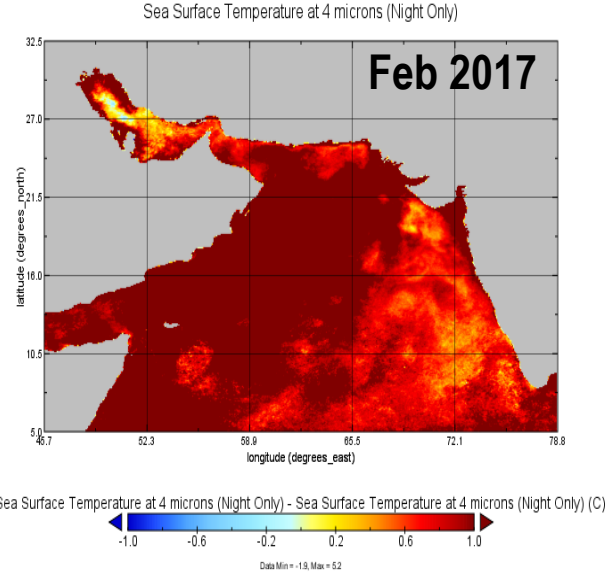






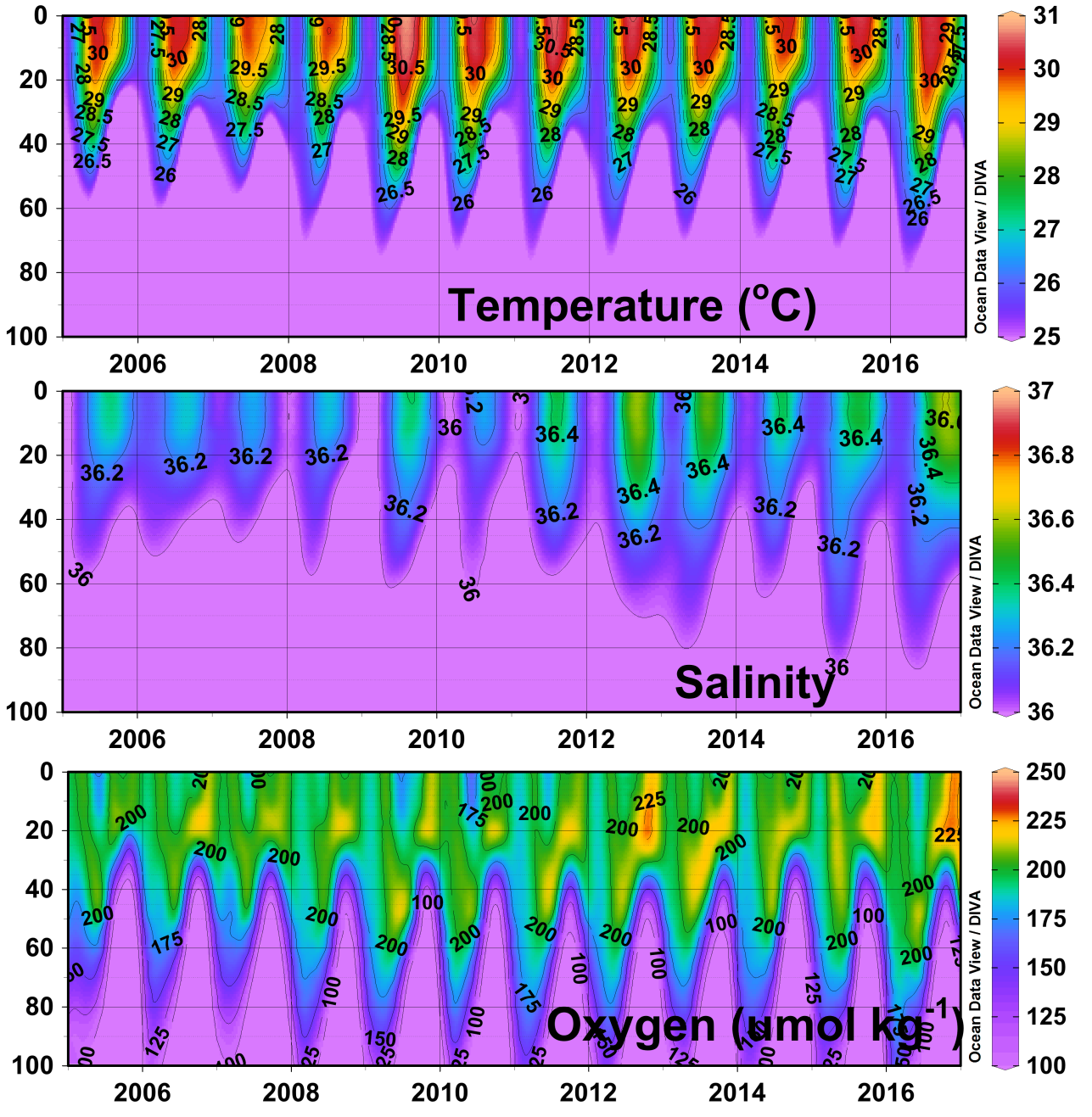




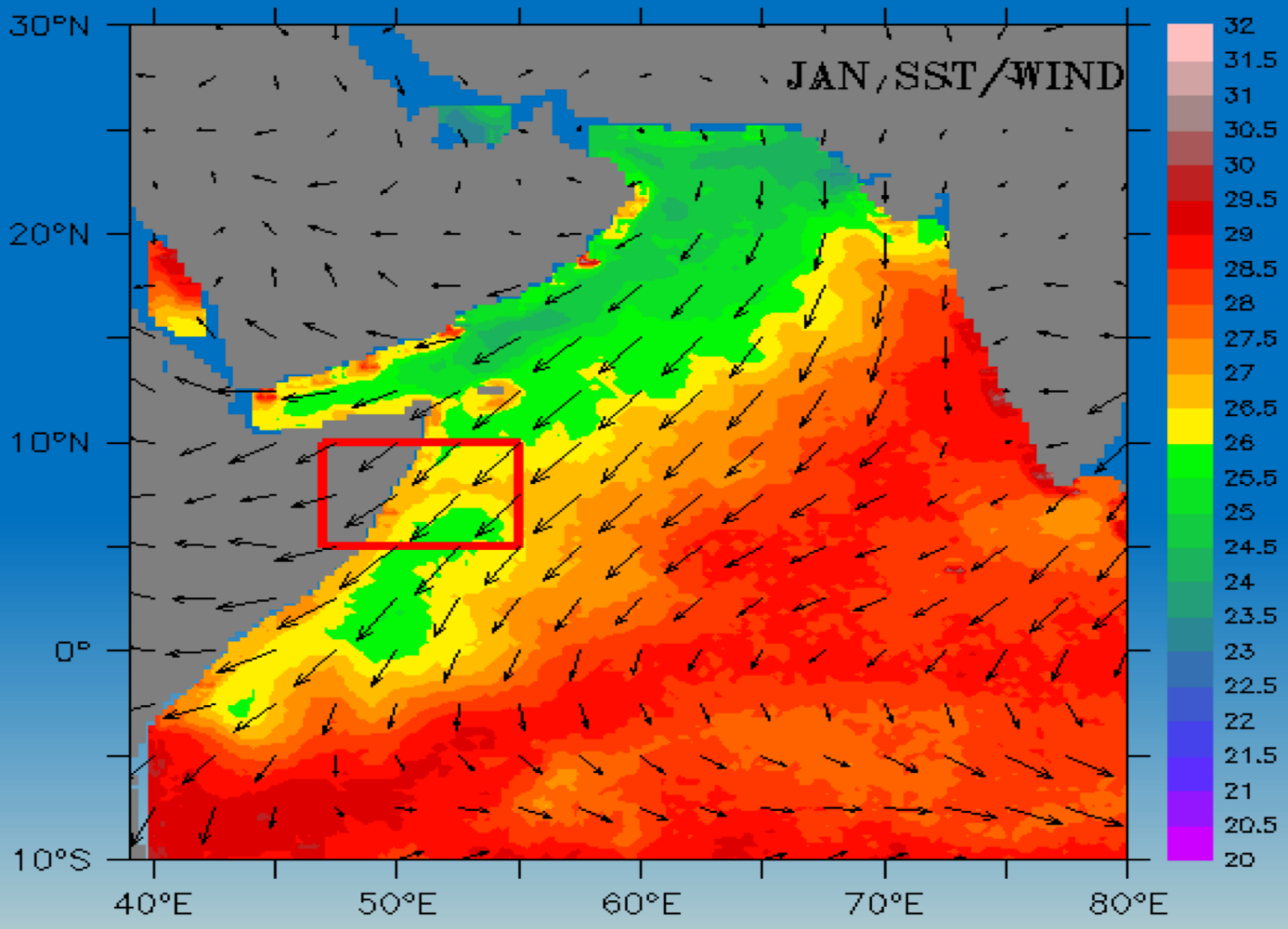


Sea surface temperature anomaly fields for the month of February

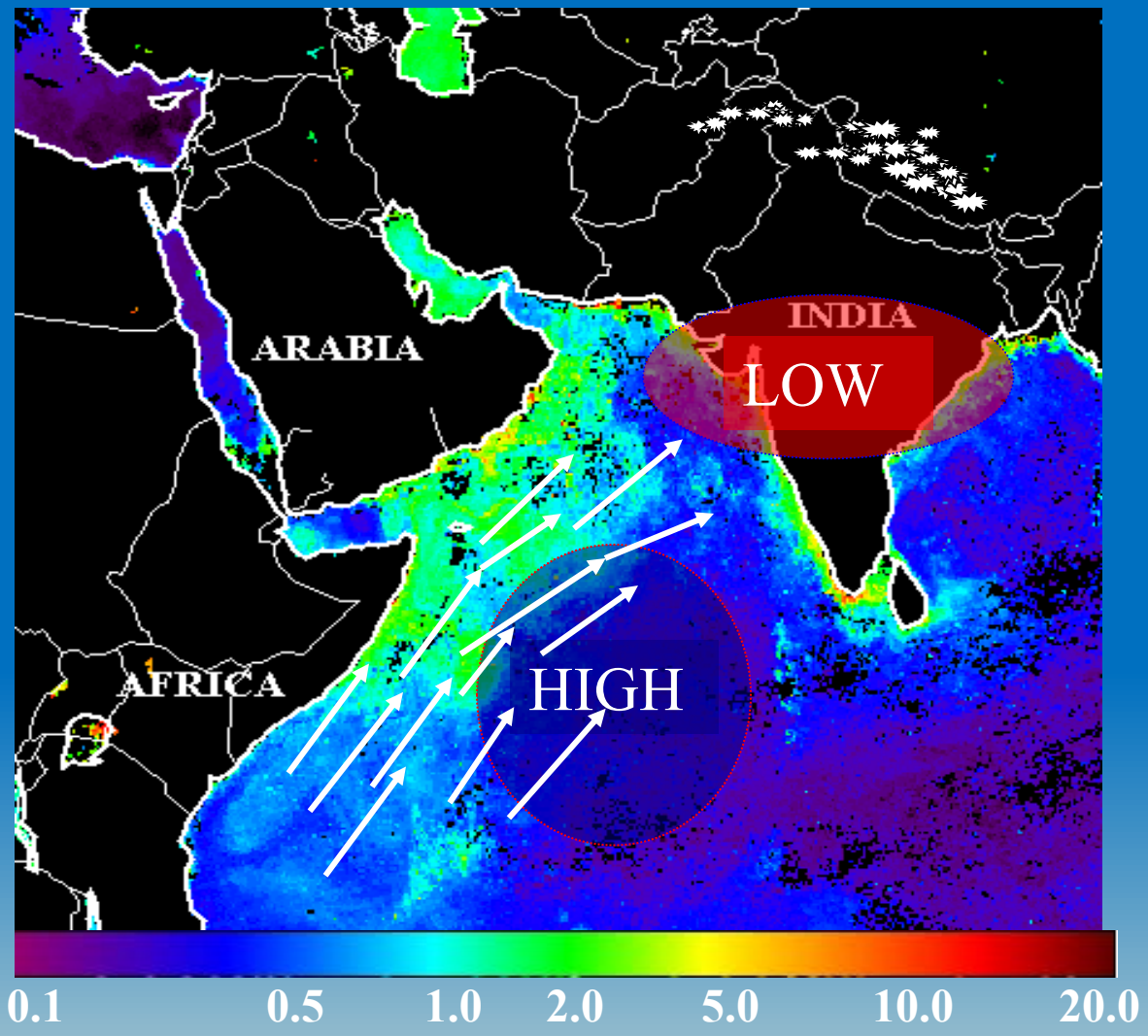
Warming and salinification surface waters in the western Arabian Sea



THE ARABIAN SEA AND ITS REVERSING MONSOONS

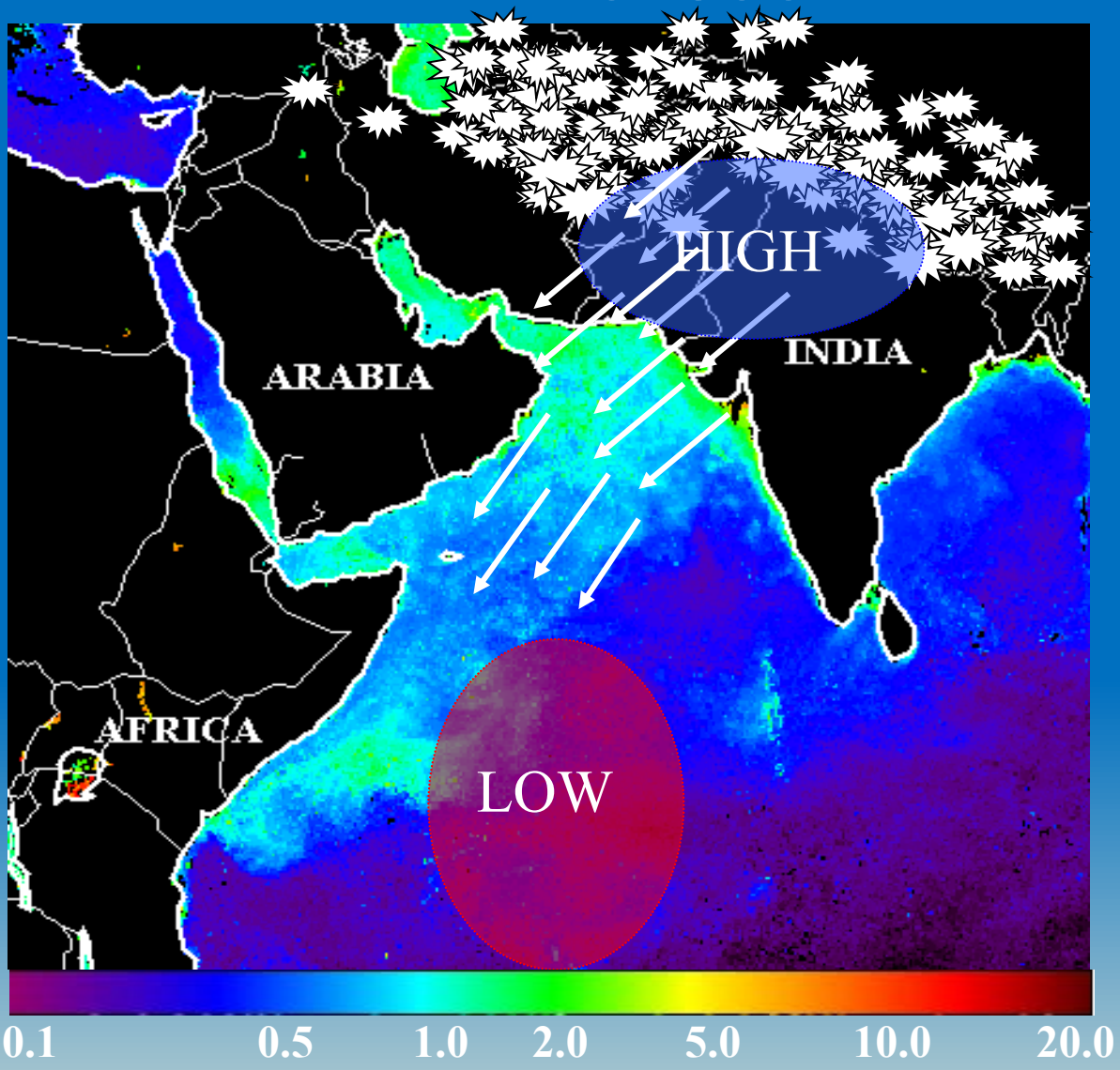


SUMMER MONSOON

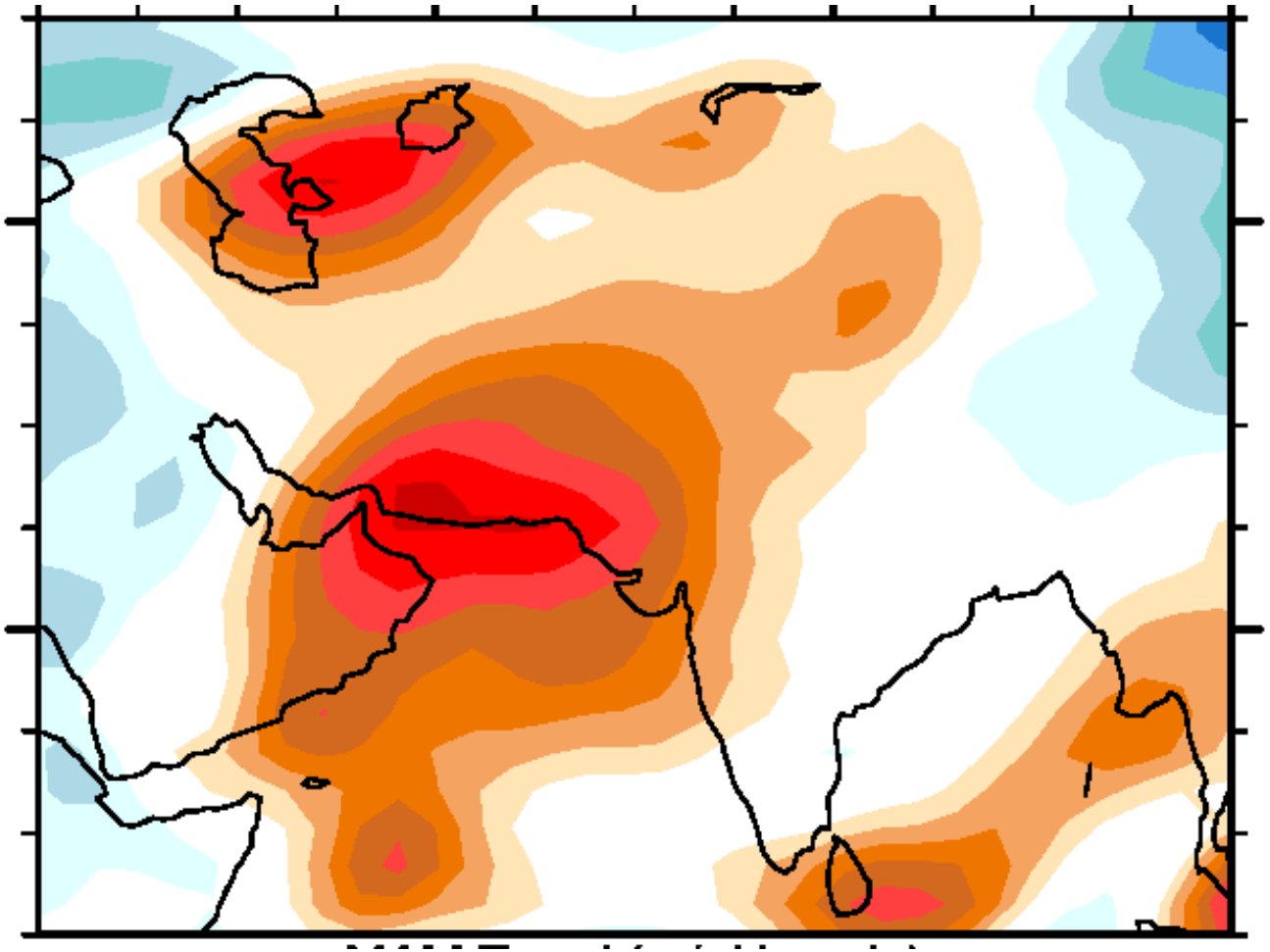


Schematic showing the reversal in wind direction during the southwest monsoon (Jun-Sept), superimposed on satellite derived chlorophyll fields

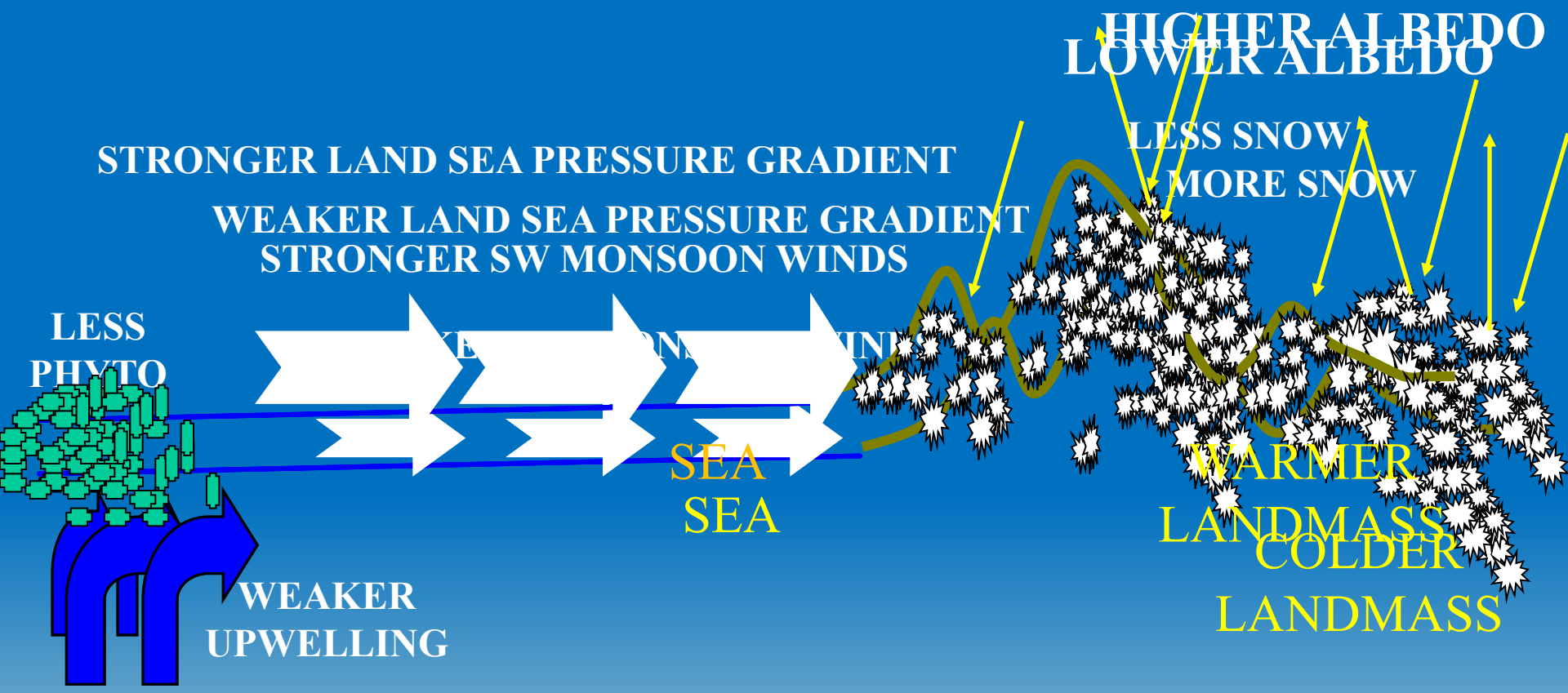
WINTER MONSOON



Schematic showing snow cover extent and wind direction superimposed on an ocean color chlorophyll image for the northeast monsoon season (Nov-Feb).

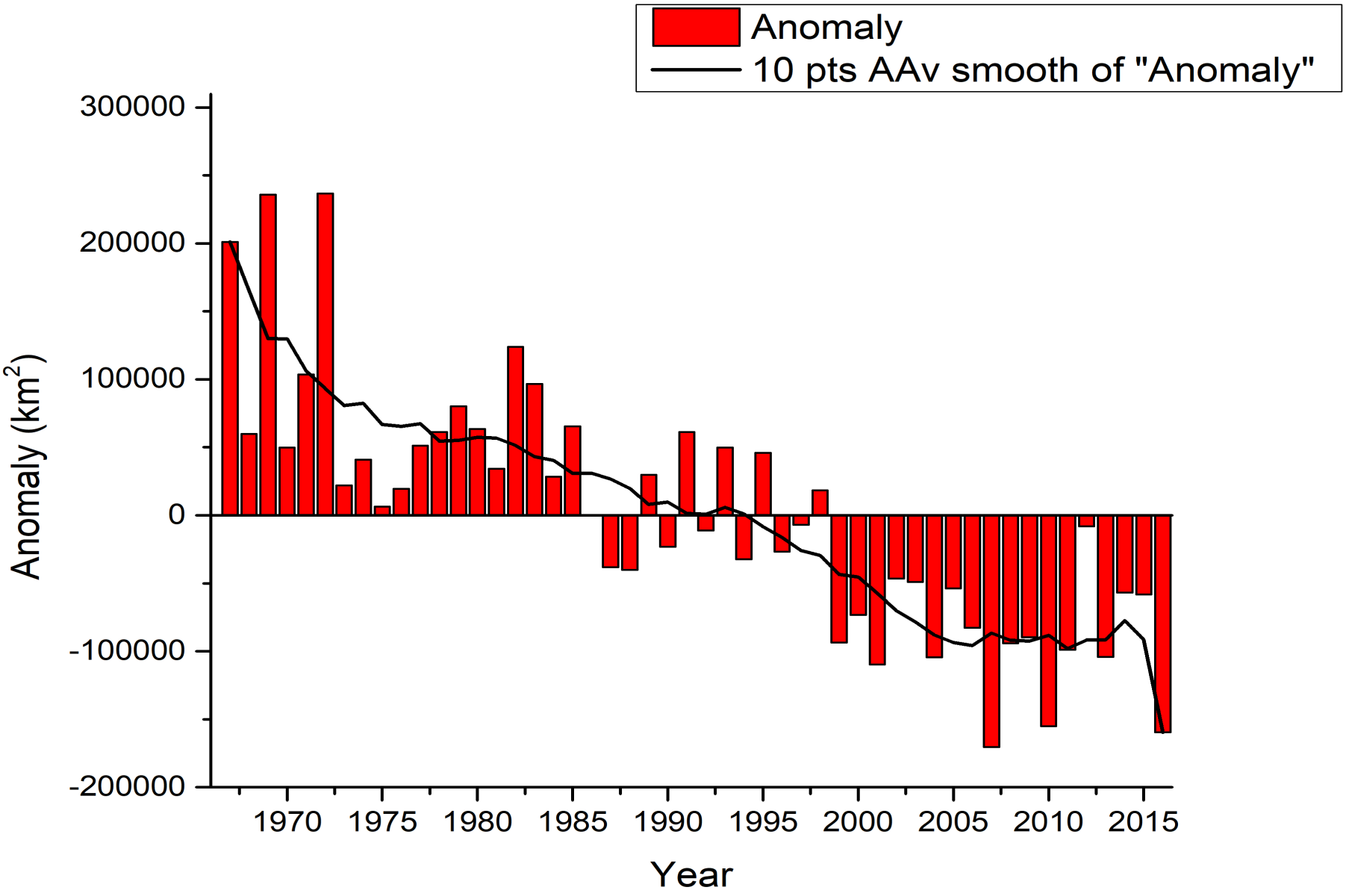


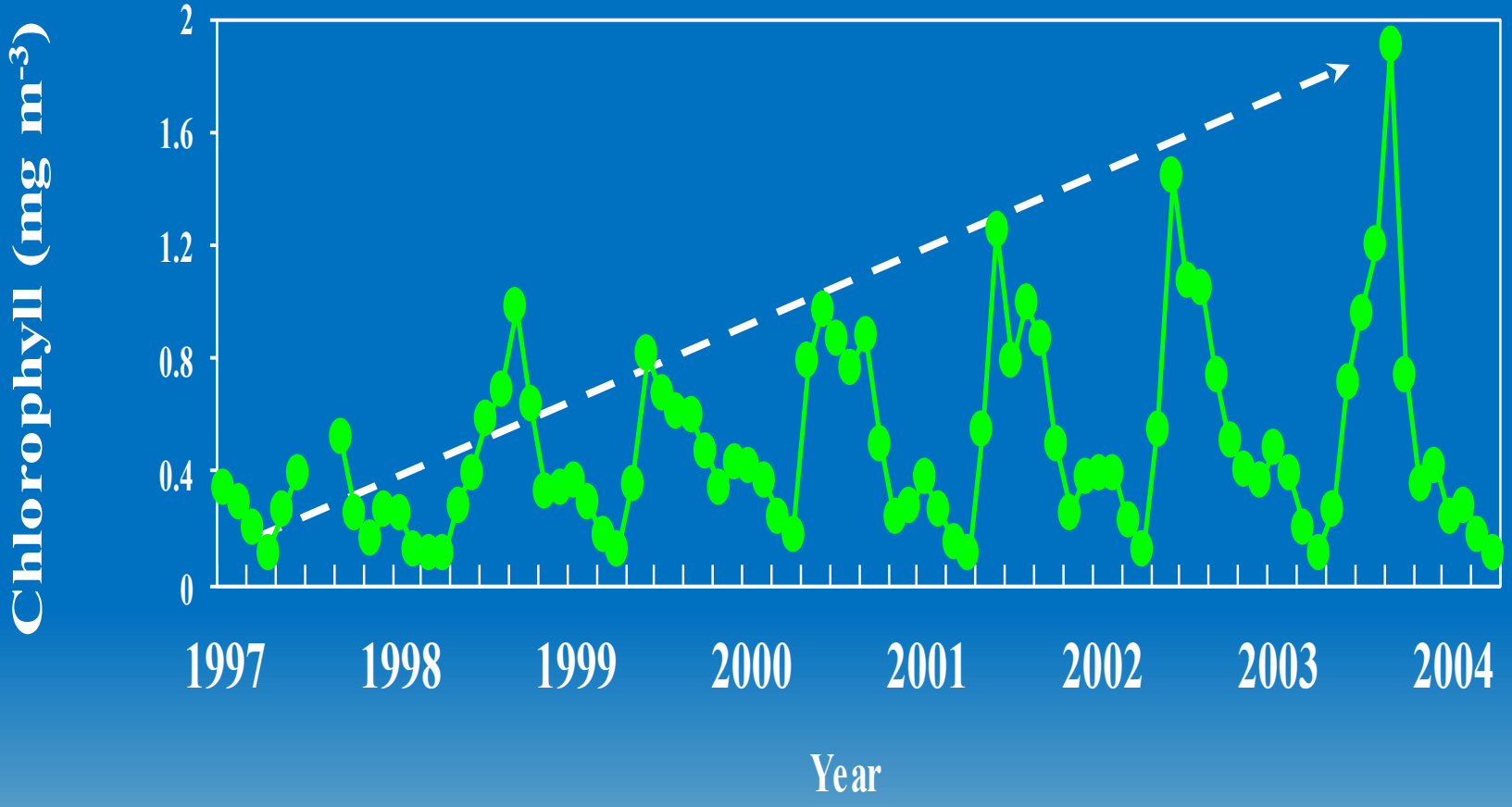
NCEP Meridional wind trends for the June-July-August from 1970 to 2010



Schematic showing the Summer Monsoon response of the Arabian Sea to snow cover over the Himalayan-Tibetan Plateau

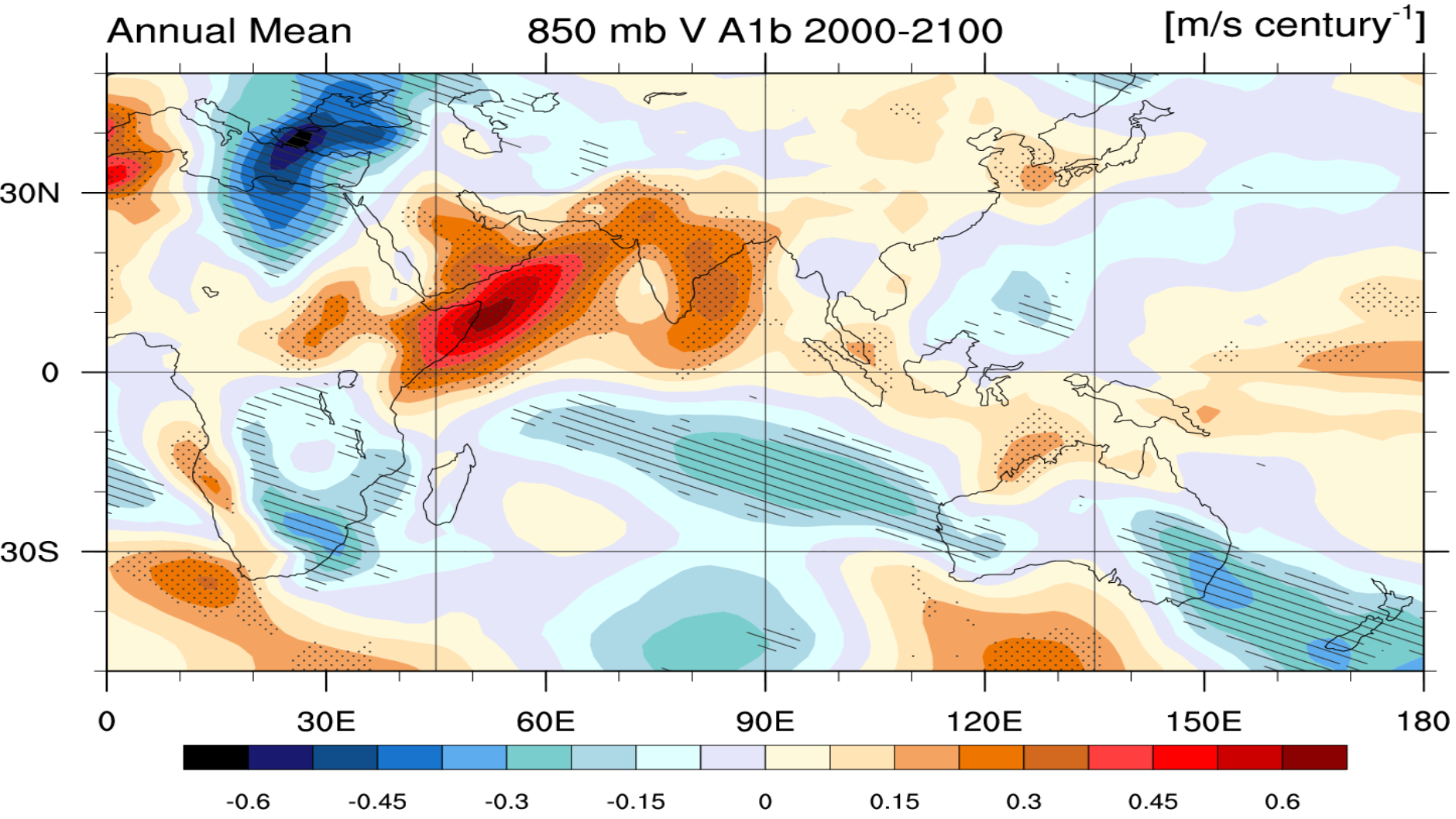
India Tibetan Snow Cover Extent



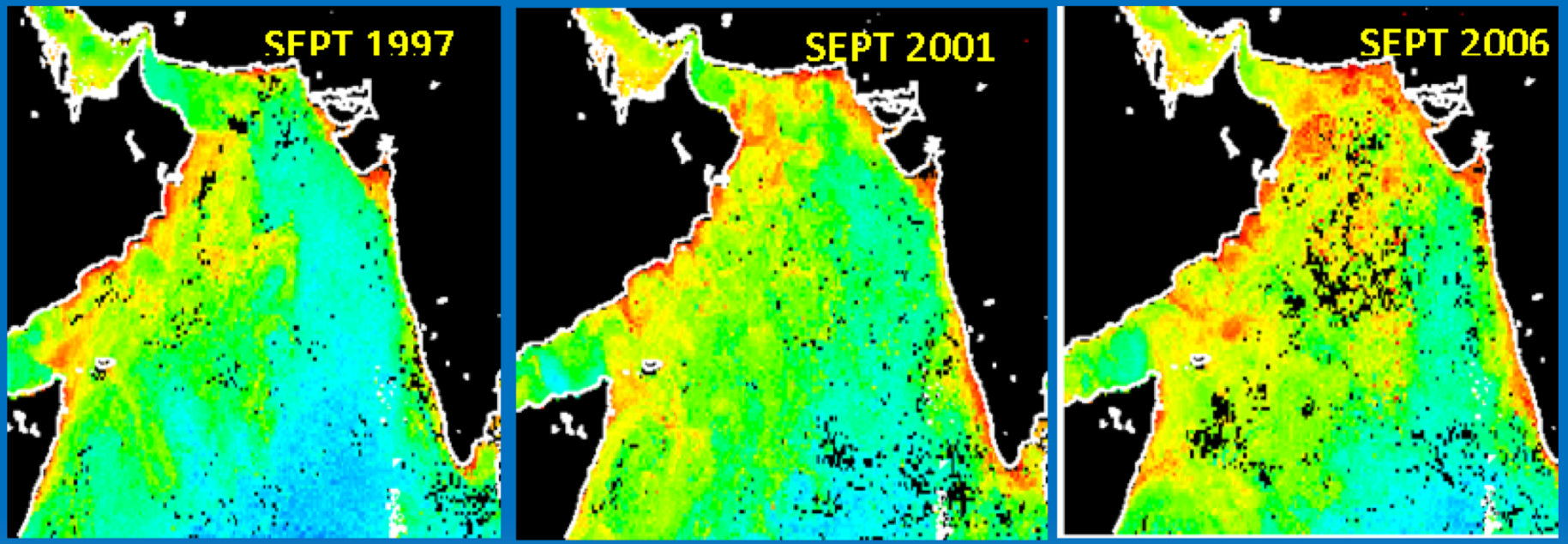


Interannual changes in chlorophyll in the core of upwelling region along coast of Somalia linked to the intensification of SW monsoonal winds

Goes et al. Science, 2005

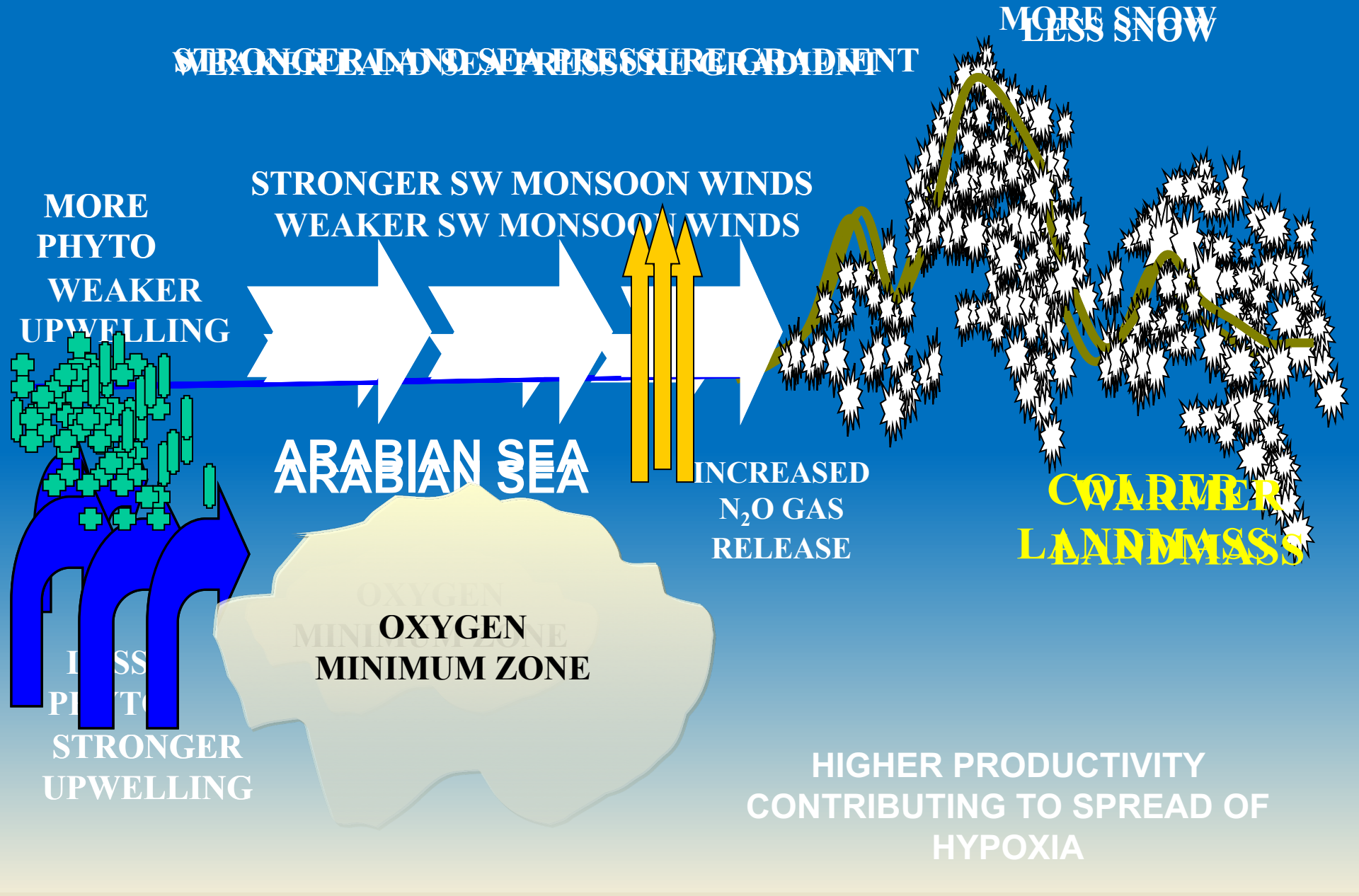


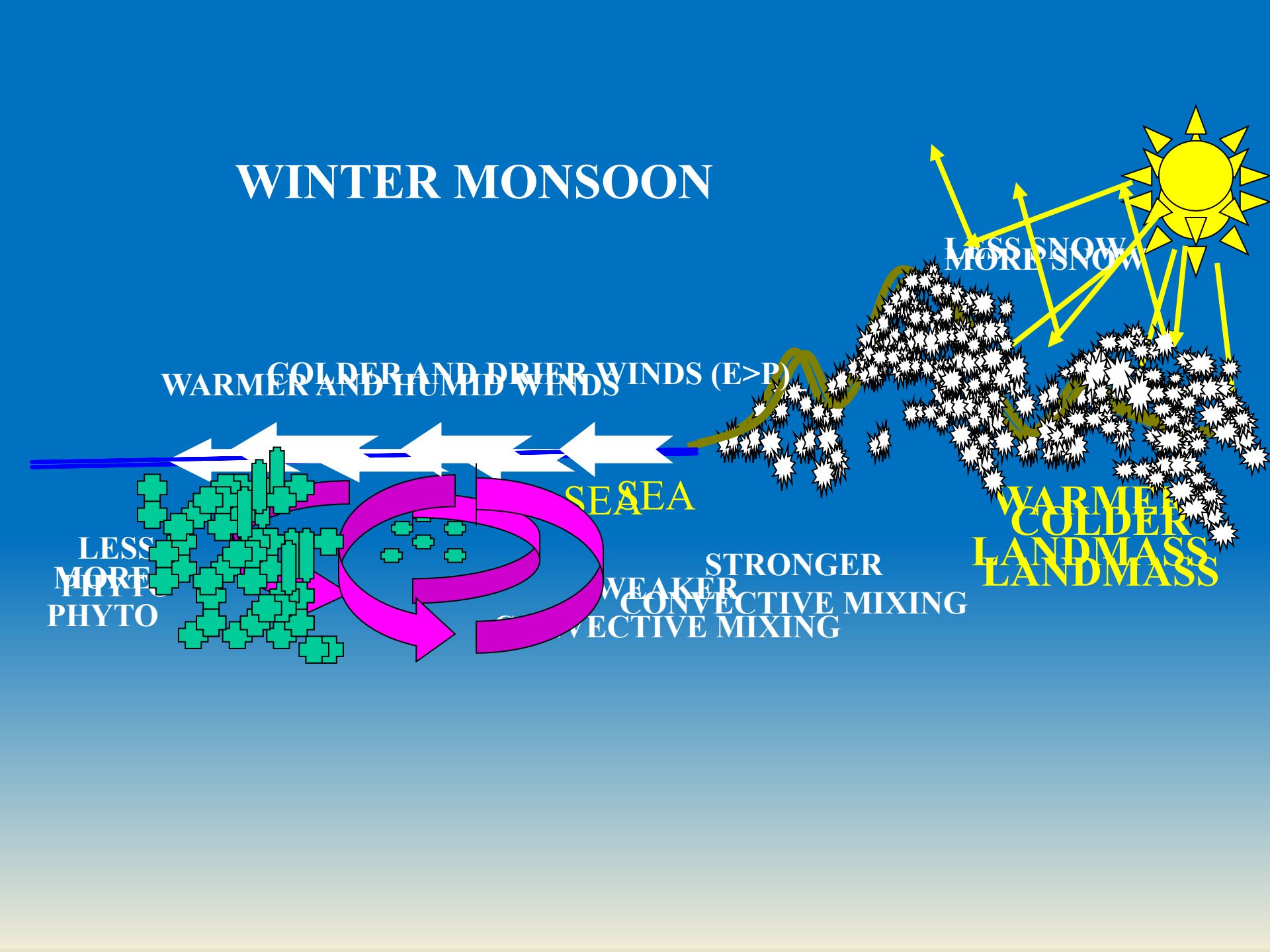
Coupled Model Intercomparison Project (CMIP5)-mean 21st Century trends in Annual Mean Meridional Wind in the Indo-Pacific Region

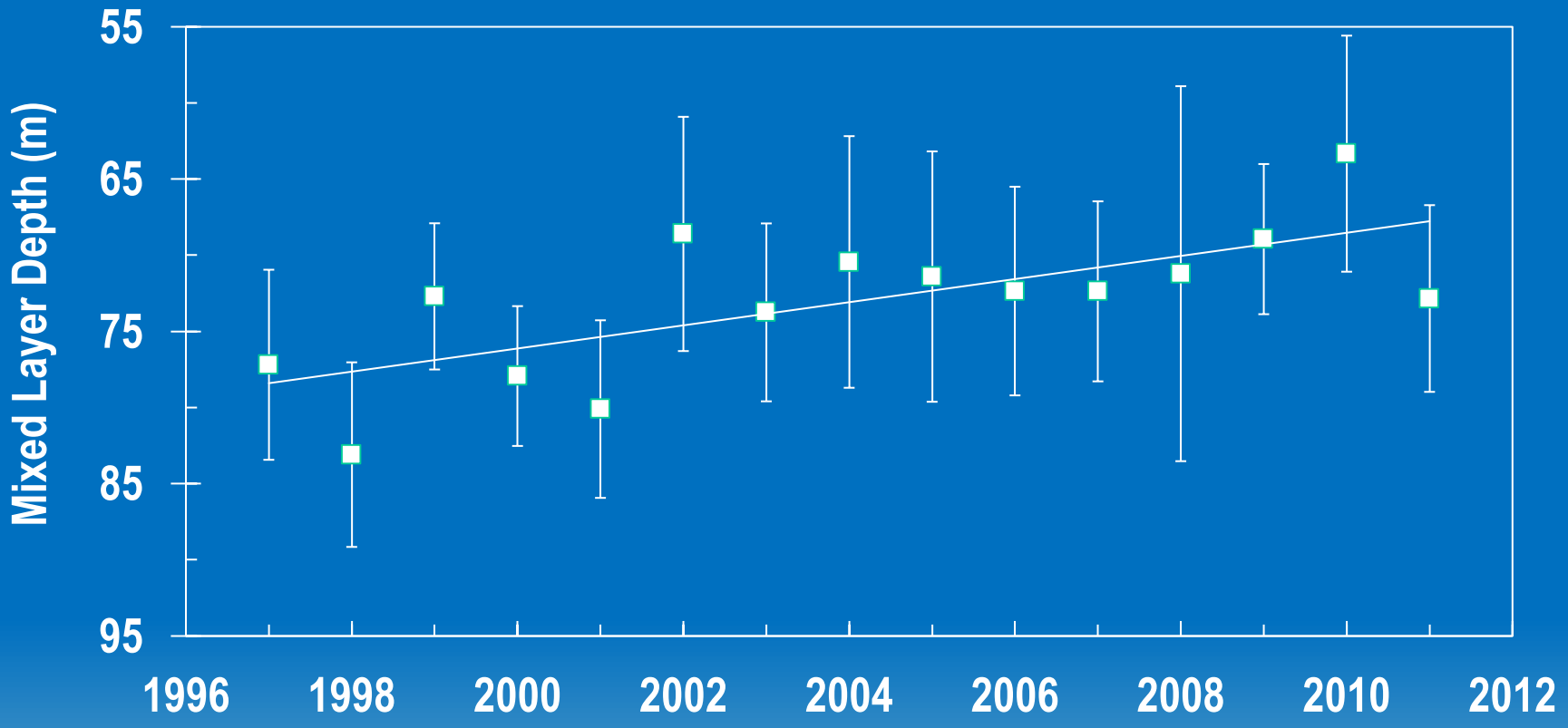


Chlorophyll fields during the peak southwest monsoon seasons of 1997, 2001 and 2006 showing continued increase in phytoplankton biomass due to intensification of winds and coastal upwelling

SCHEMATIC SHOWING THE IMPACTS OF INCREASING PRODUCTIVITY ON THE ARABIAN SEA




WINTER MONSOON
LESS SNOW
MORE SNOW
COLDER AND DRIER WINDS (E>P)
WARMER AND HUMID WINDS
SEA
SEA
WARMER
COLDER
LANDMASS
LANDMASS
LESS
MORE
PHYTO
PHYTO
STRONGER
CONVECTIVE MIXING
WEAKER
CONVECTIVE MIXING



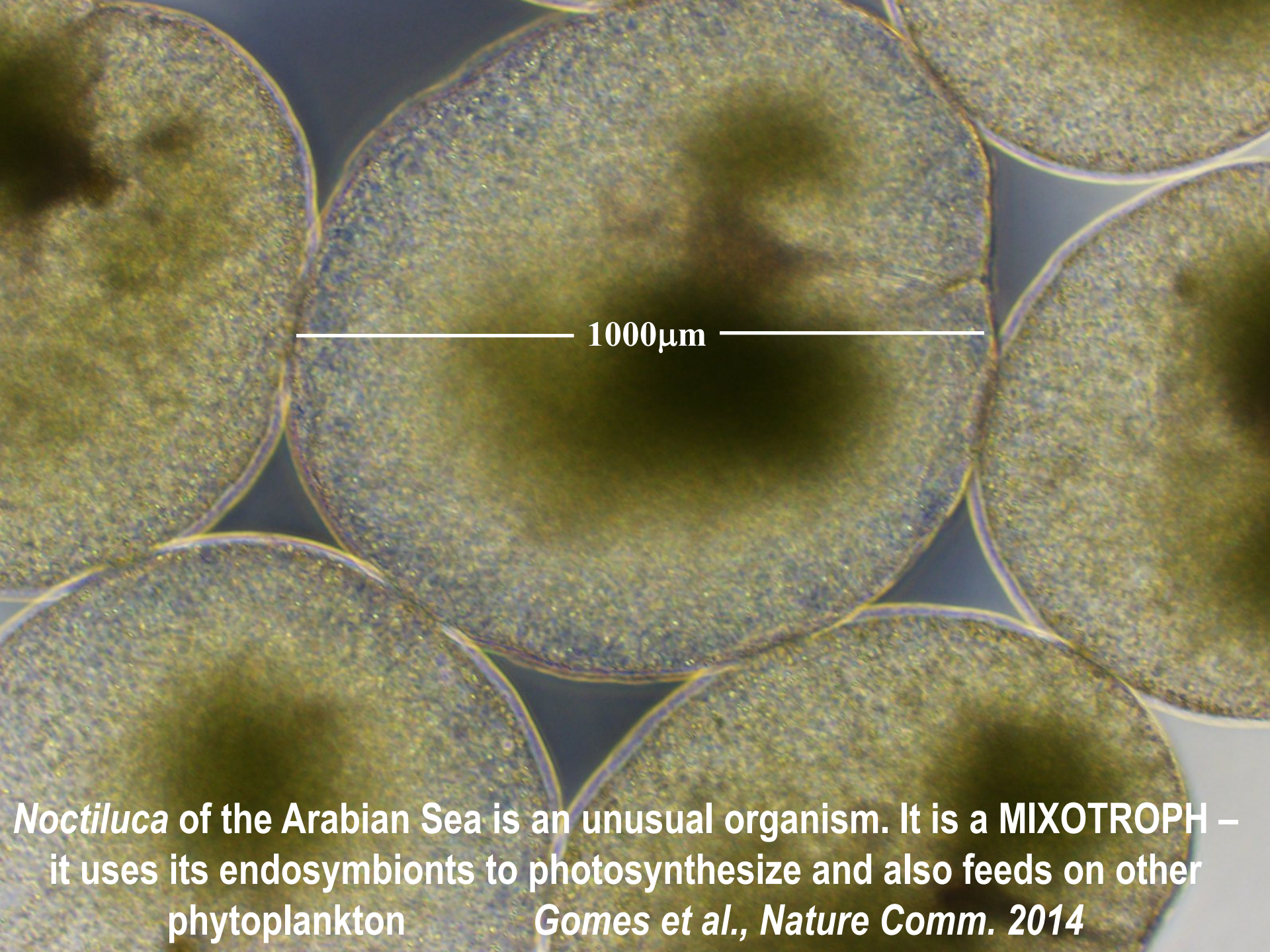
Annual trends of Mixed Layer Depth (NCEP-GODAS) indicating weakening of winter convective mixing in the northern Arabian Sea during the NE monsoon

20th Feb 2009

MAN

INDIA

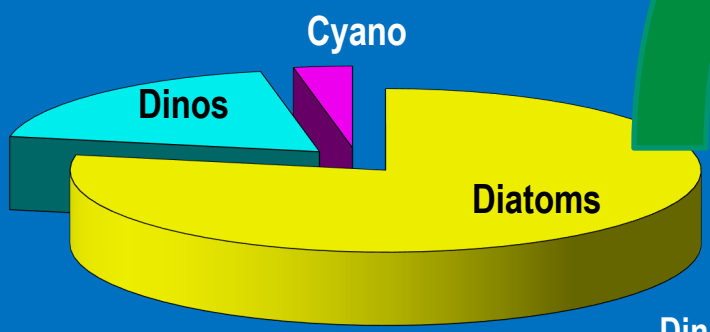
58 60 62 64 18 66 68 70 72



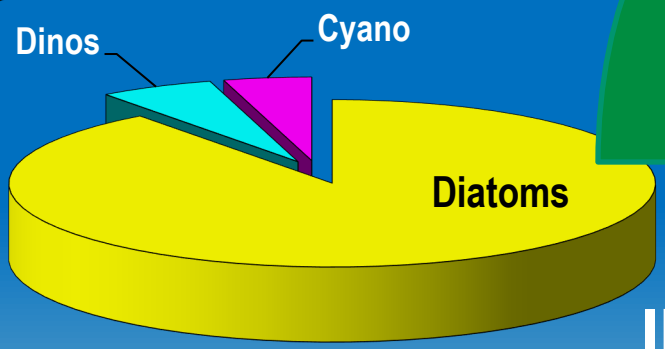
Noctiluca of the Arabian Sea is an unusual organism. It is a MIXOTROPH – it uses its endosymbionts to photosynthesize and also feeds on other phytoplankton *Gomes et al., Nature Comm. 2014*

ARABIAN SEA PHYTOPLANKTON COMMUNITY STRUCTURE

IIOE - 1960's



JGOFS -1990's



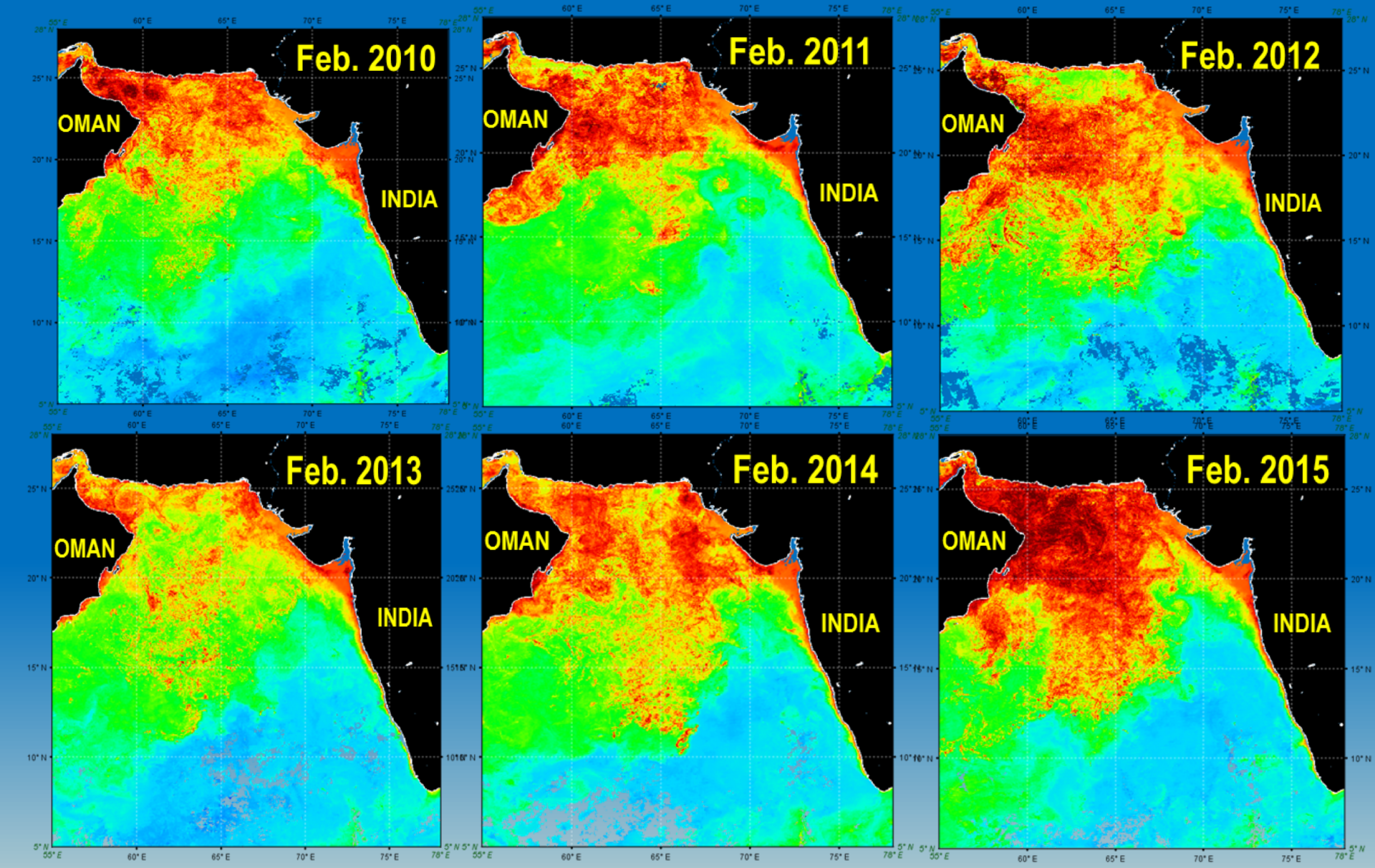
INDIA-OMAN 2011


Salps

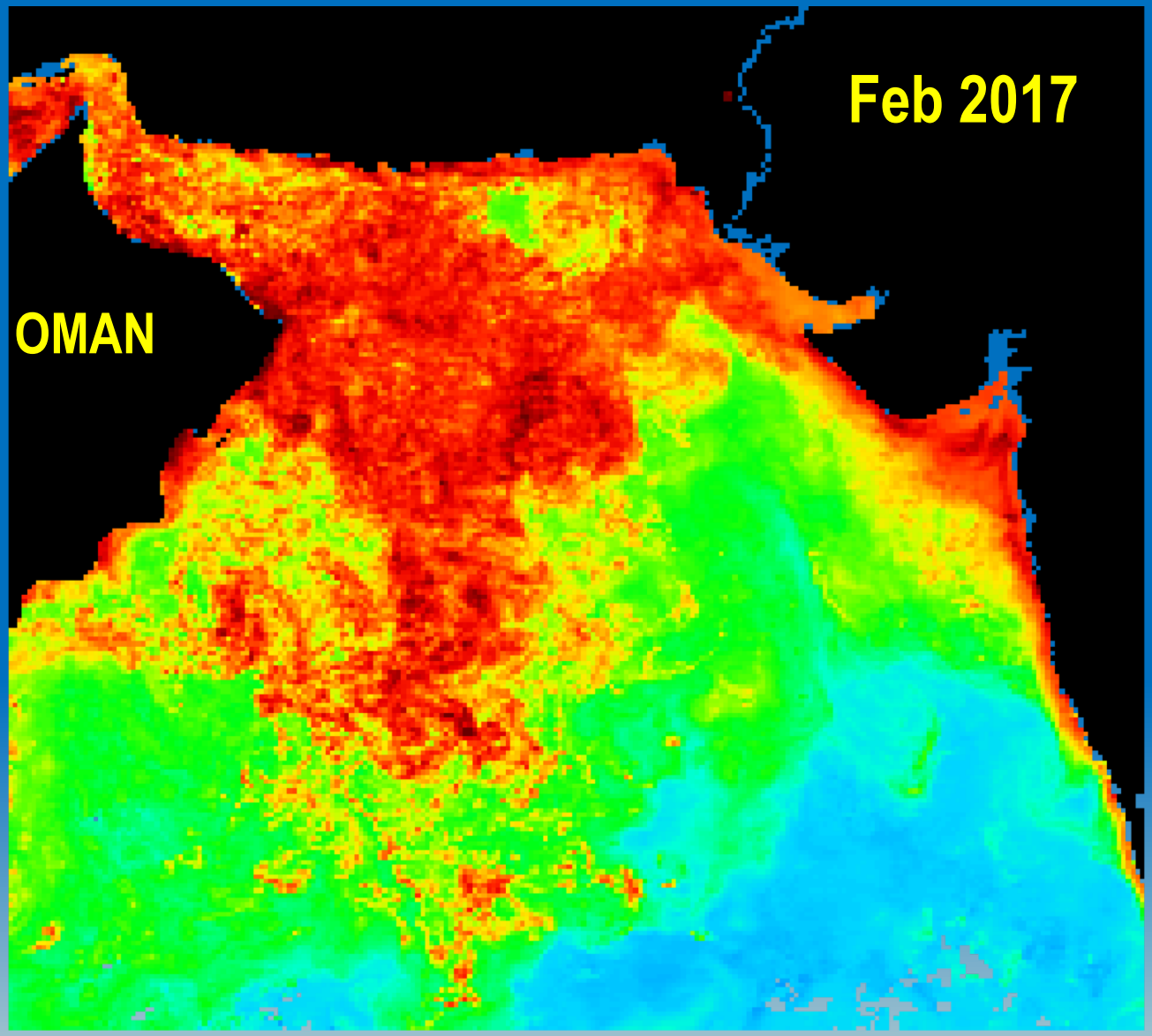

Salp gut


Squid


Turtle



NASA's MODIS-Aqua monthly composite images of Chl *a* in the Arabian Sea showing the spatial expanse of *Noctiluca* blooms



Noctiluca bloom of 2017

Algae outbreak suffocates thousands of sardines in Oman

Residents of Sidab village teamed up to clean the area before the smell of dead fish spread

Image Credit: Twitter

The sardines had choked to death due to the lack of oxygen in the seawater.

FILED UNDER

GulfNews › News › Gulf › Oman

ALSO IN OMAN

Omani killed in car accident in Batinah region

Follow us

WEST COAST OF INDIA

FEB 2017

JUNE 2017

WEST COAST OF INDIA – OCT 2017

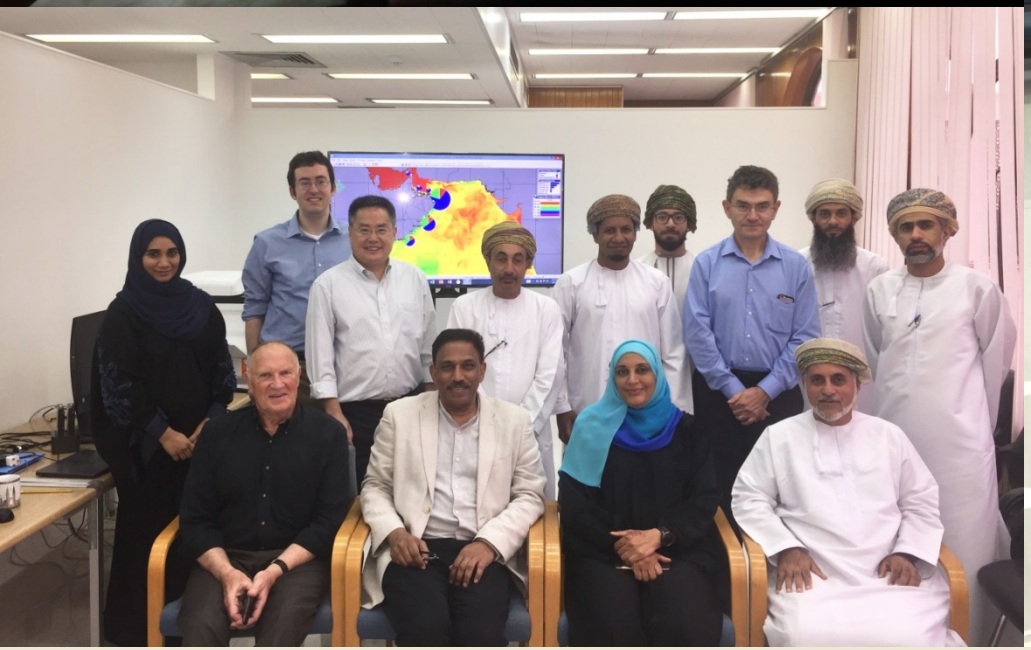
MAJOR GOALS OF NASA-DISCO PROJECT

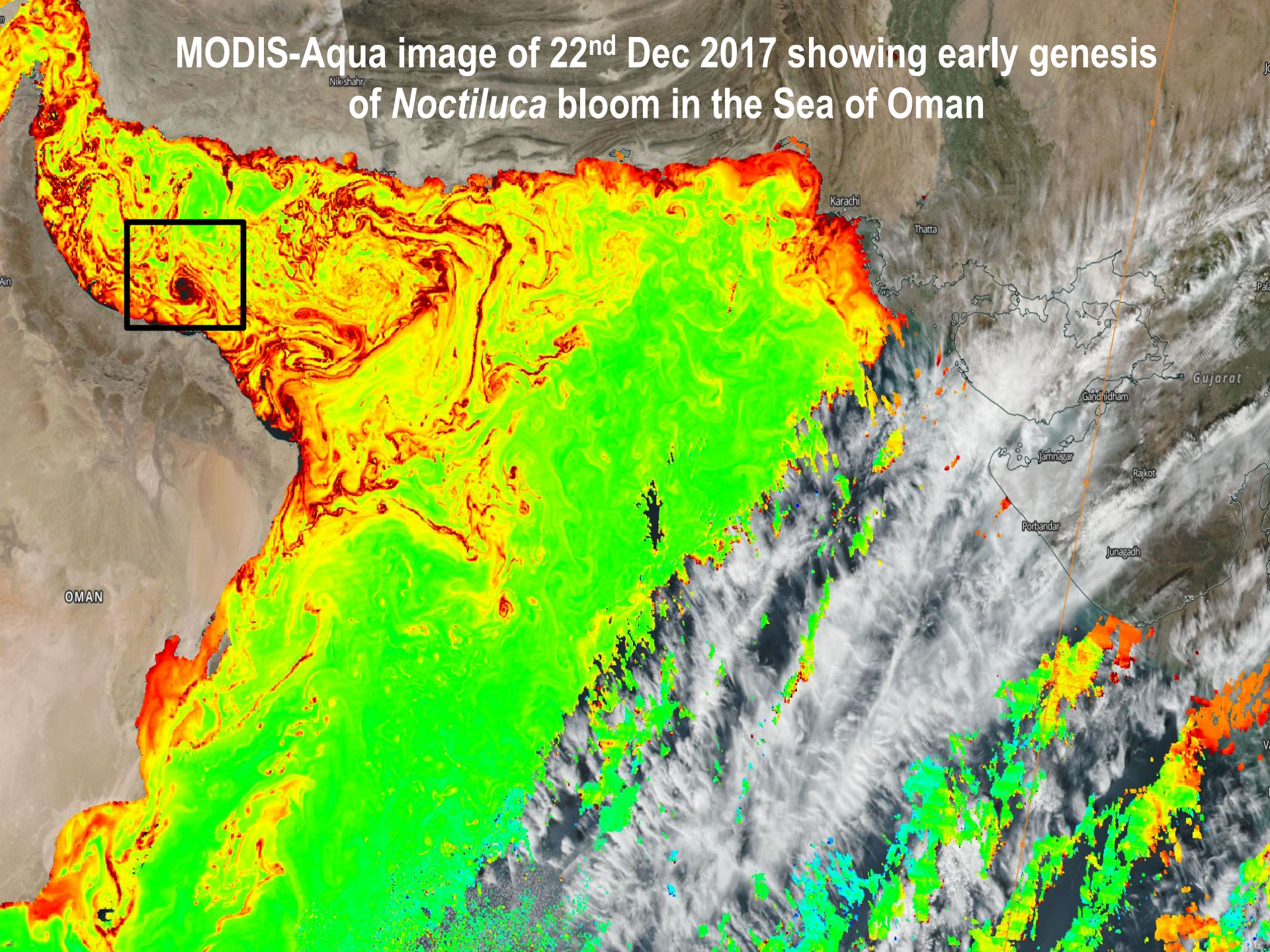
To develop in collaboration with Omani scientists an information system to aid management of Oman's Coastal Resources

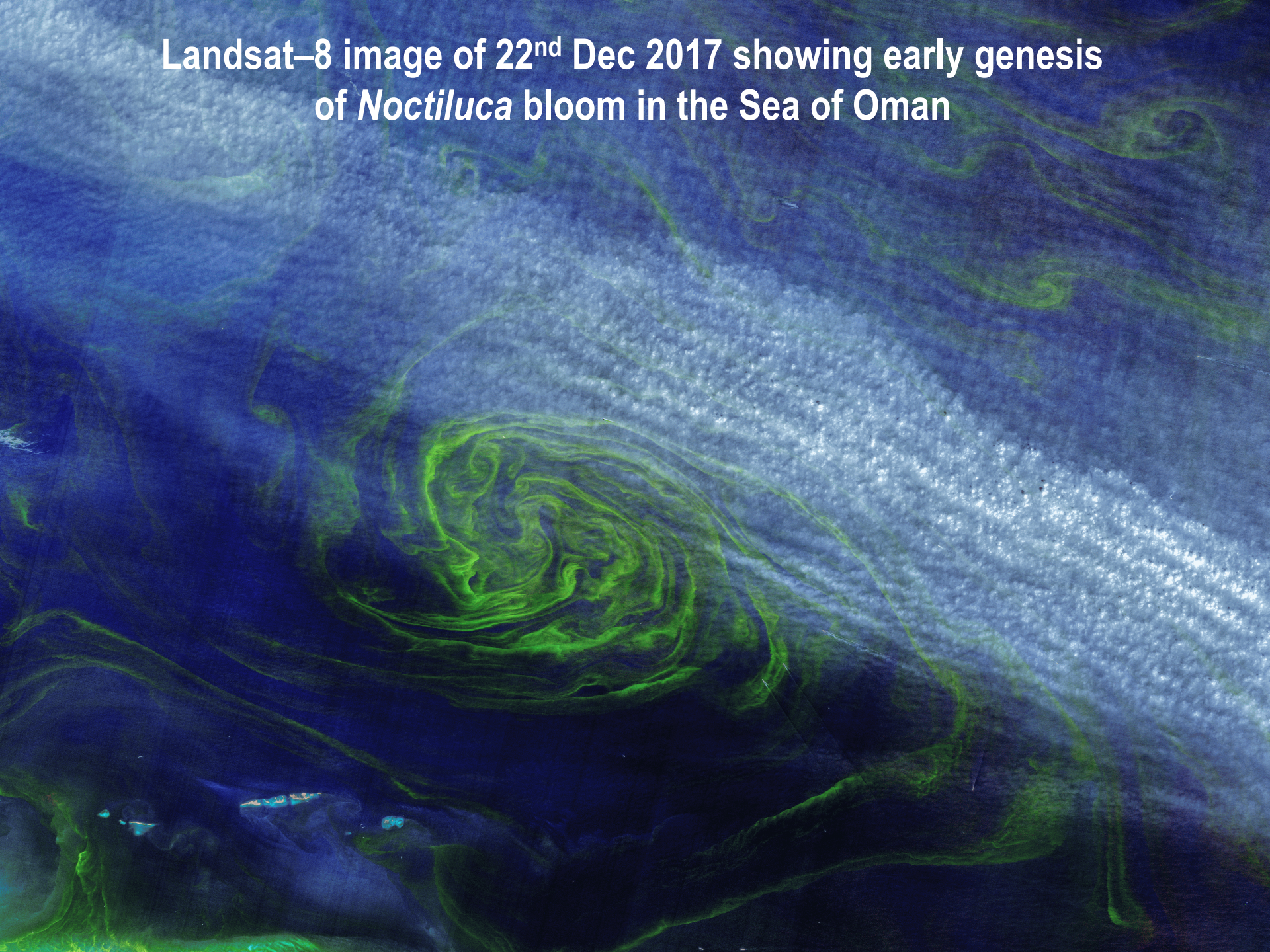
Specifically, these products will aid in:

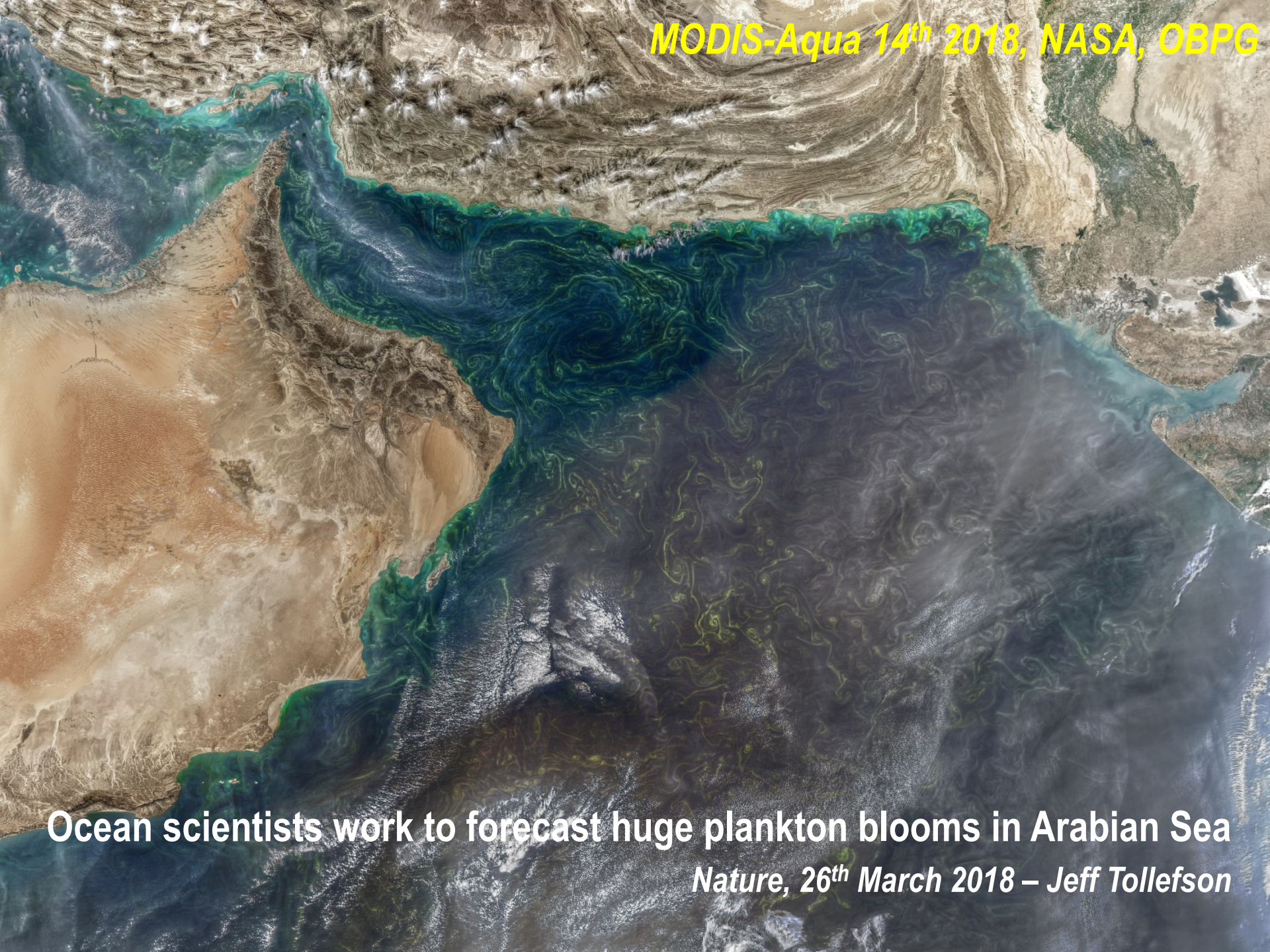
- **Mapping sea state conditions around the coast of Oman**
- **Eddies for establishing line for discharge of ballast water**
- **Early warnings of hypoxic waters and locations prone to fish kills**
- **Early warning for algal blooms and their dispersal along the coast**
- **Tools for long-term coastal resources and fisheries management**

WORKSHOP, MUSCAT-OMAN - DEC 2017




MODIS-Aqua image of 22nd Dec 2017 showing early genesis of *Noctiluca* bloom in the Sea of Oman
Nikshahr
Karachi
Thatta
Gujarat
Gandhidham
Jamnagar
Rajkot
Porbandar
Junagadh
OMAN


Landsat–8 image of 22nd Dec 2017 showing early genesis
of *Noctiluca* bloom in the Sea of Oman



Ocean scientists work to forecast huge plankton blooms in Arabian Sea

Nature, 26th March 2018 – Jeff Tollefson

Fishermen- Qaryat

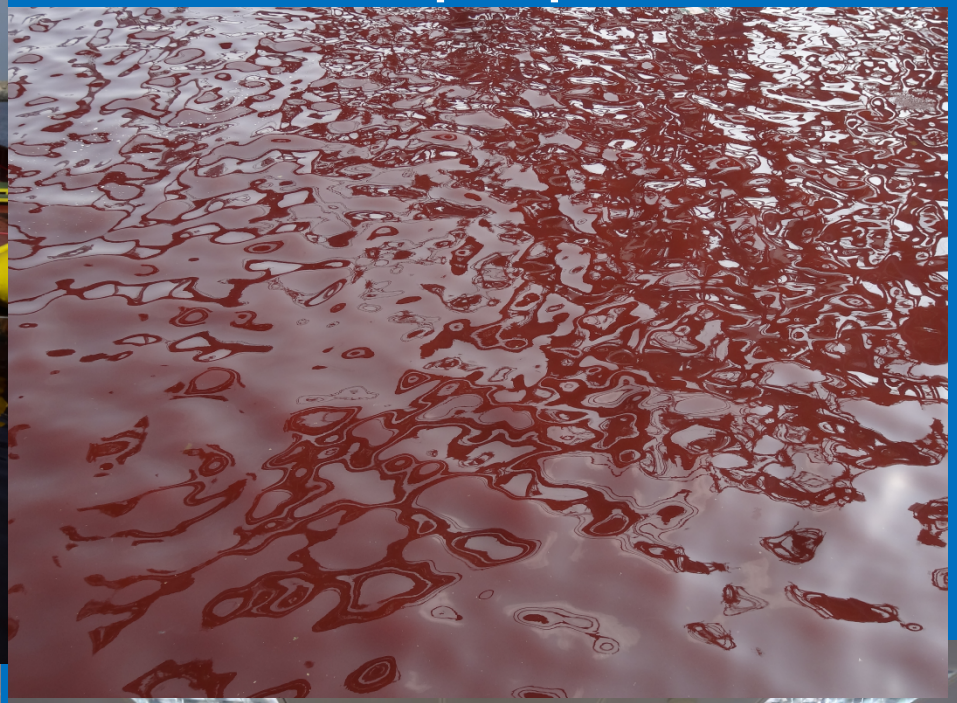
Fish-farm- Qaryat

Refinery- Sohar

Desalination plant - Sohar

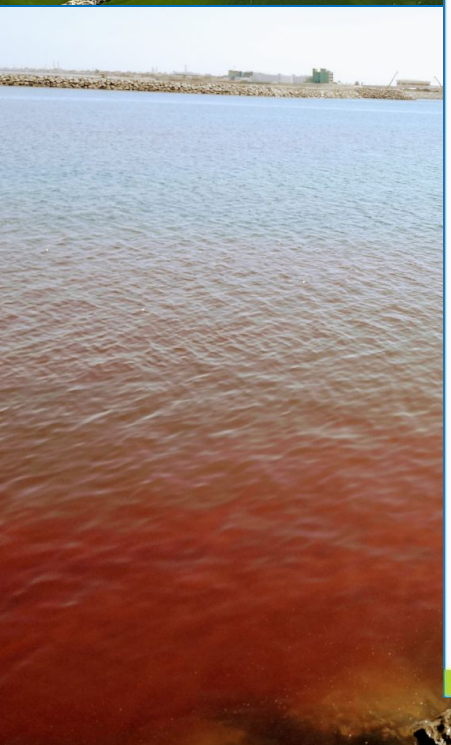
Sohar Divers

Sohar Ship Repair Port



Royal Oman Navy

Royal Oman Navy



نفخر بخدمتكم أينما كنتم
Proud to serve you wherever you are

ديم Diam

بيان رقم (٢)

«متابعة حالة المد الأحمر في ولاية بركاء»

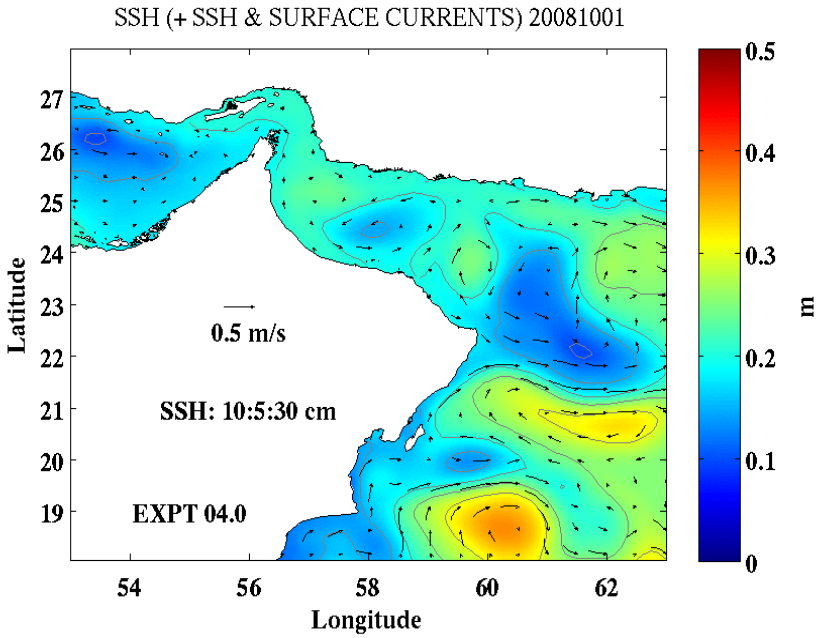
التاريخ: ٢٥ فبراير ٢٠١٨م، الساعة ١٠:٠٠ مساءً

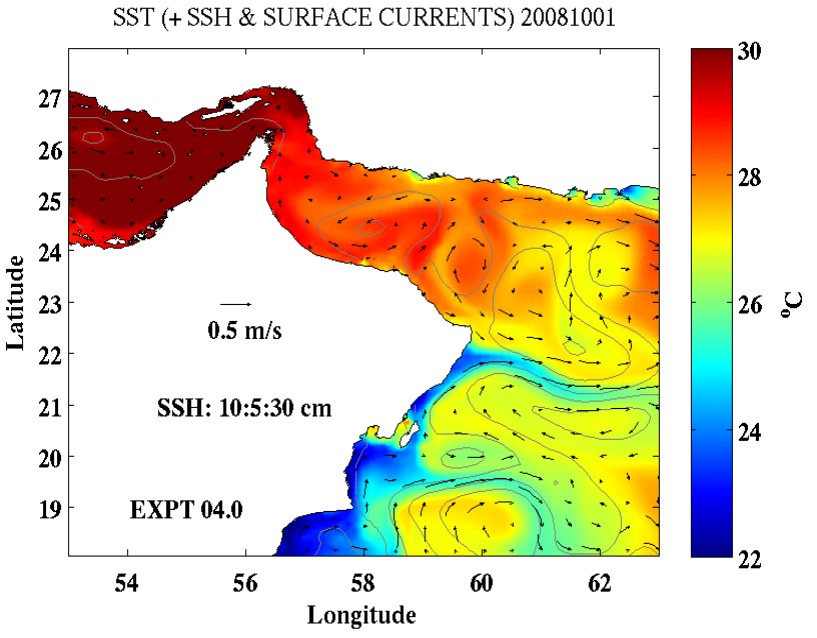
تواصل اللجنة الرئيسية للطوارئ المنعقدة في الهيئة العامة للكهرباء والمياه (ديم) مراقبة ومتابعة حالة المد الأحمر في مياه البحر المحاذية لولاية بركاء وقد أوضحت البيانات من المركز الوطني للمراقبة والتحكم الرئيسي للمياه في ولاية بوشر عن استمرار حالة المد الأحمر وتأثيرها على وحدات التحلية، نتج عنه تذبذب في إنتاج المياه من محطات التحلية ببركاء ، وتقوم الفرق الميدانية التابعة لشركات التحلية بمتابعة وقياس نسبة العوالق في مياه البحر بشكل مستمر لضمان التشغيل الآمن لوحدات التحلية.

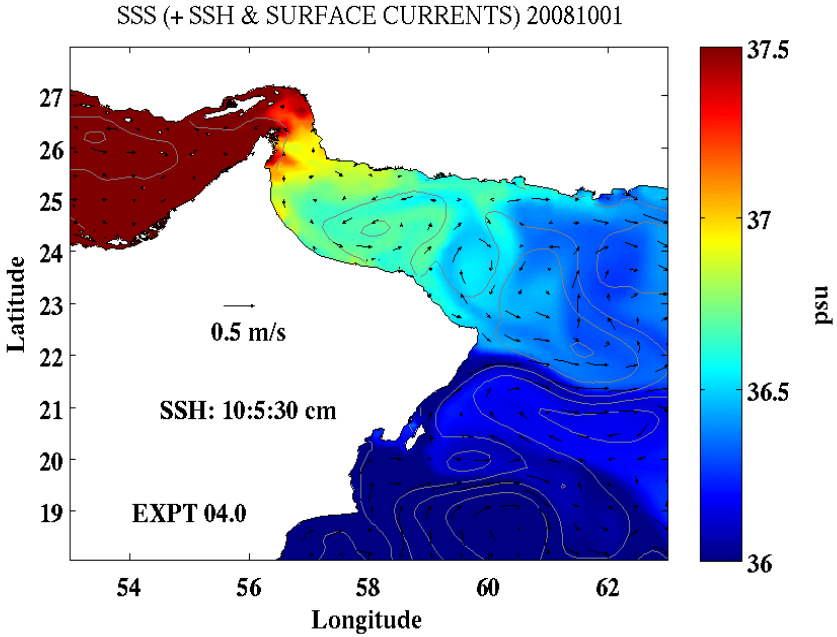
هذا وقد استمرت اللجنة بمتابعة تطبيق خطط الاستجابة للطوارئ في ولاية السيب بمحافظة مسقط وولايات محافظة الداخلية لضمان عدم تأثر المشتركين بخدمة المياه في المناطق التي تزودها محطات التحلية في ولاية بركاء ولم يسجل أي نقص أو انقطاع في إمدادات المياه حتى صدور هذا البيان.

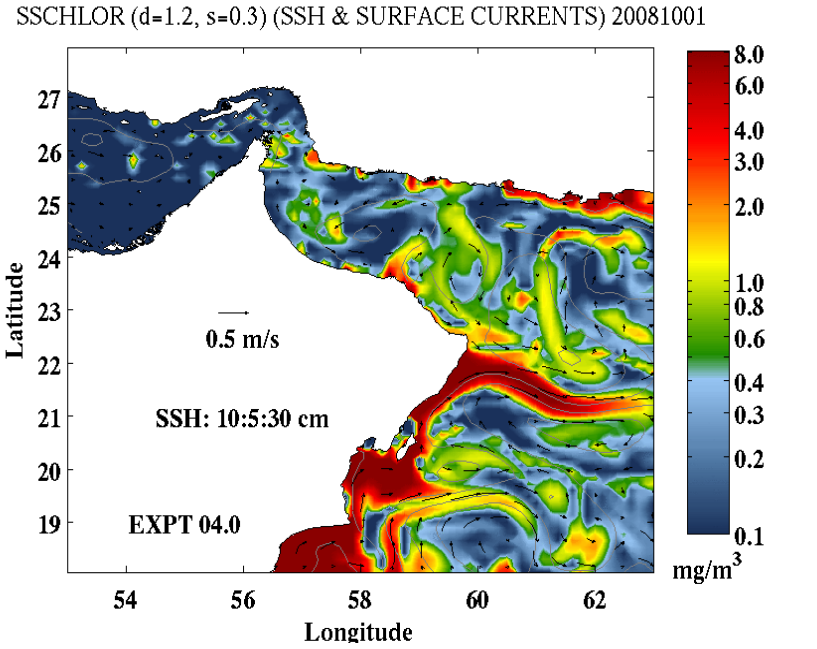
وتواصل اللجنة الرئيسية للطوارئ في الهيئة العامة للكهرباء والمياه (ديم) متابع الحالة عن كثب، وتدعو كافة المشتركين الكرام في ولاية السيب بمحافظة مسقط وولايات محافظة الداخلية إلى مواصلة ترشيد استهلاك المياه.

والله ولي التوفيق،

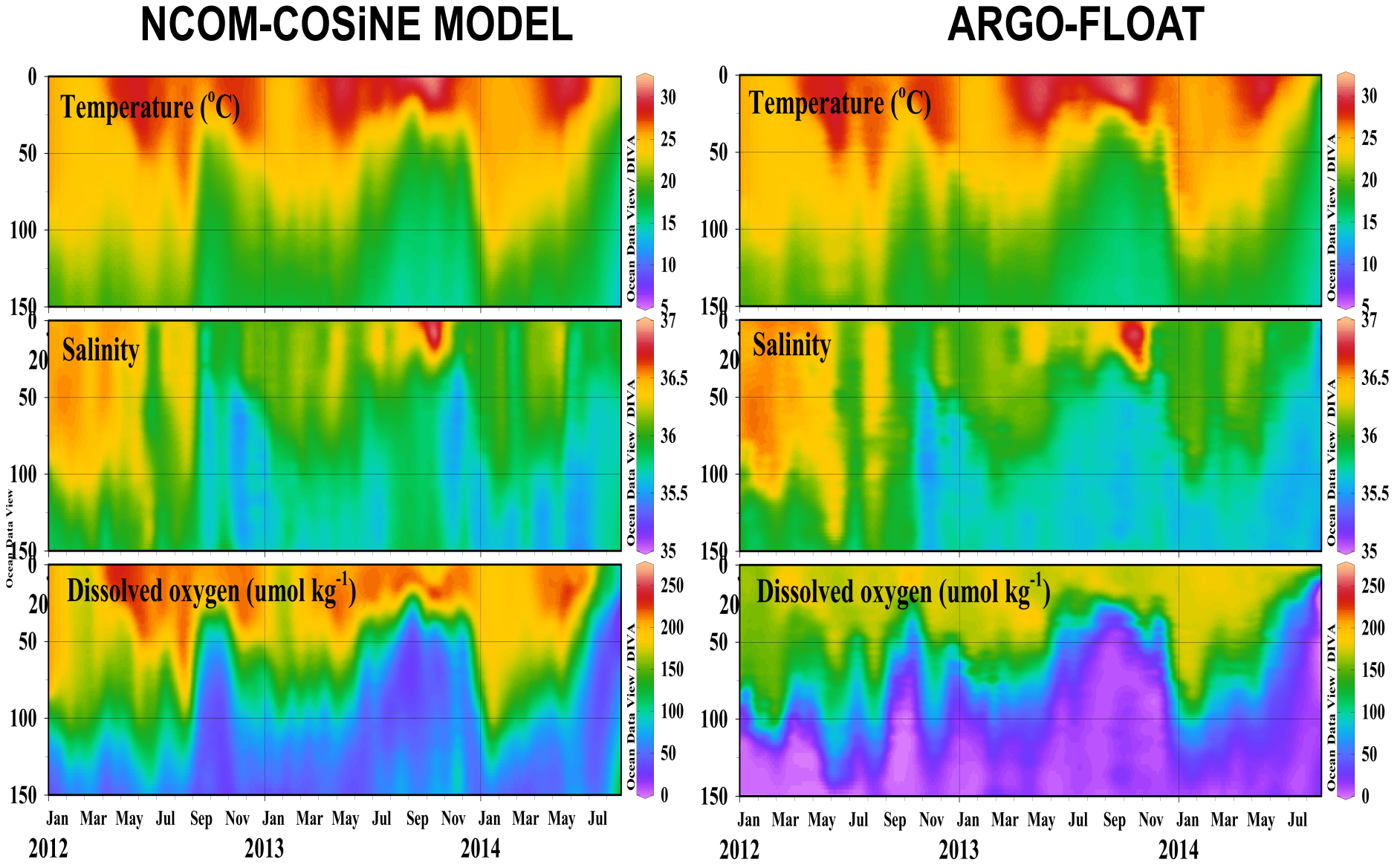








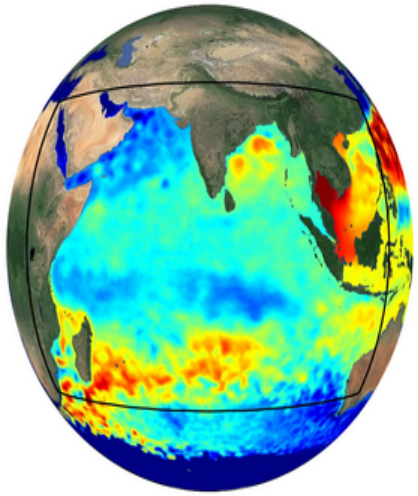
Outputs of NCOM-COSiNE model

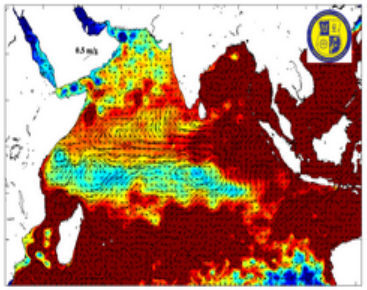


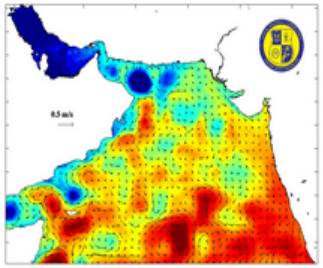
Comparison of NCOM-COSiNE outputs with ARGO Float data off the coast of Oman

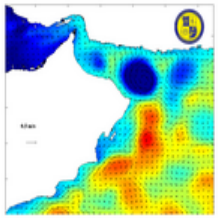
Gulf of Oman REAL TIME FORECASTING SYSTEM

LAMONT-DOHERTY EARTH OBSERVATORY
THE EARTH INSTITUTE AT COLUMBIA UNIVERSITY





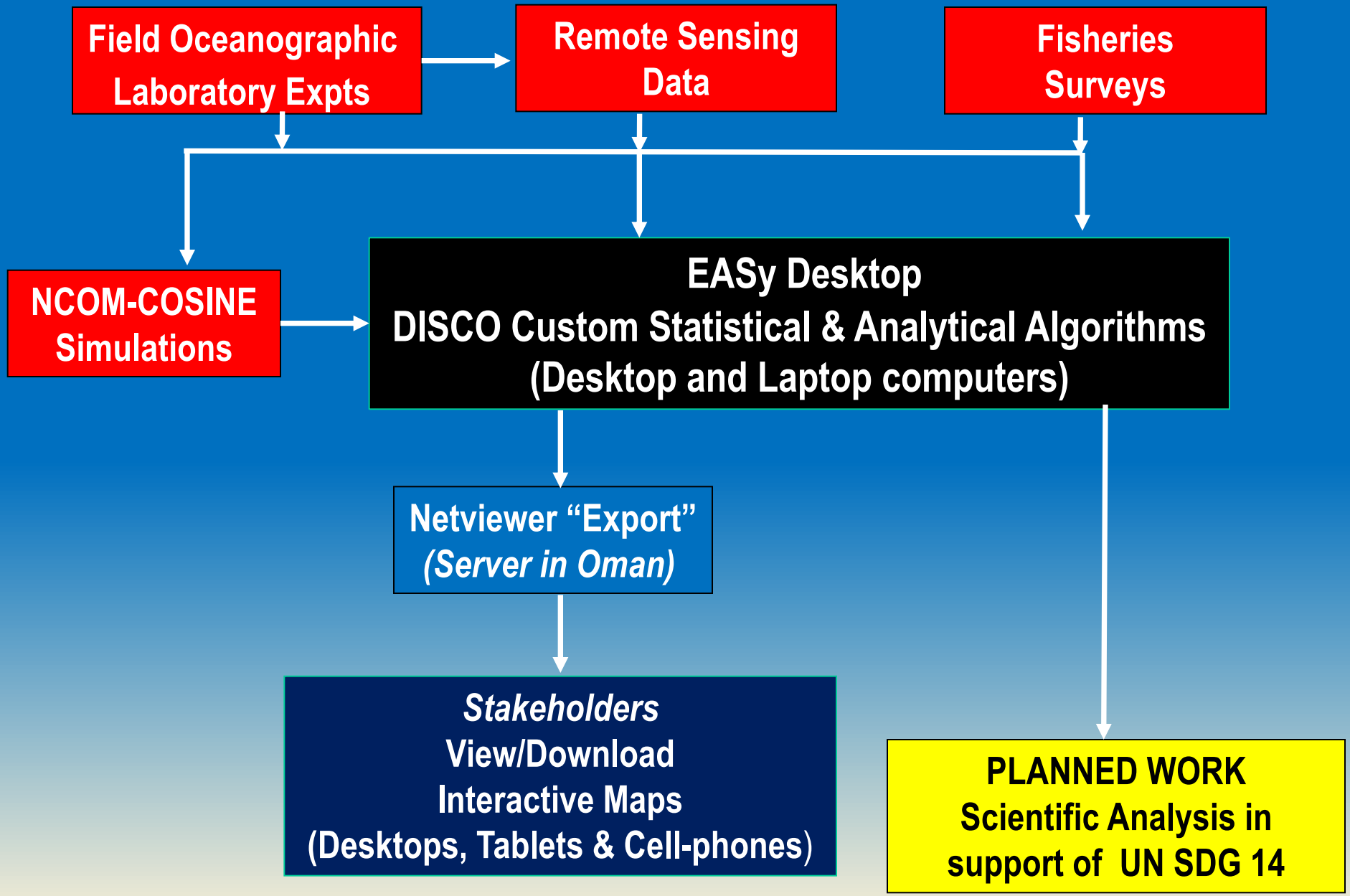




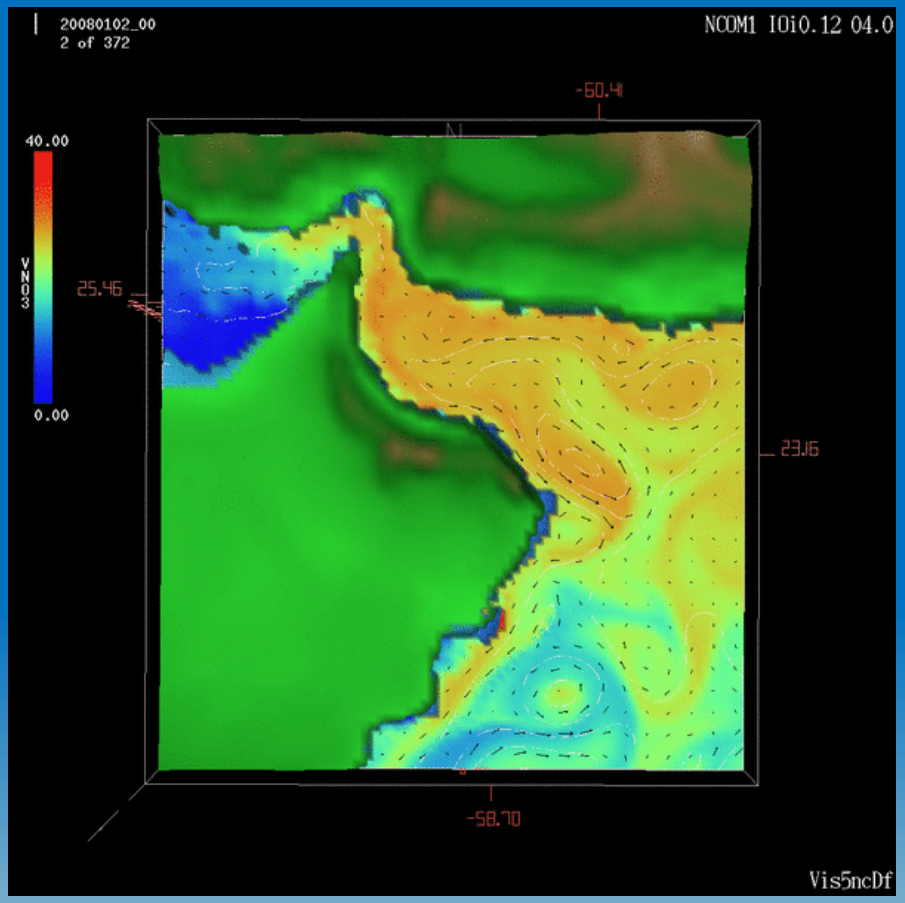
Forecasts
Analyses

05/12/2015 00 GMT: Today's nowcast is derived from the NRL Global Operational Forecasting System (GOFS), focusing on the regions of interest (interpolated from the global model) using a Quad-Nested Approach (Global: Indian Ocean: Arabian Sea: Gulf of Oman). Hover over each figure to read a synopsis; click for details and results.

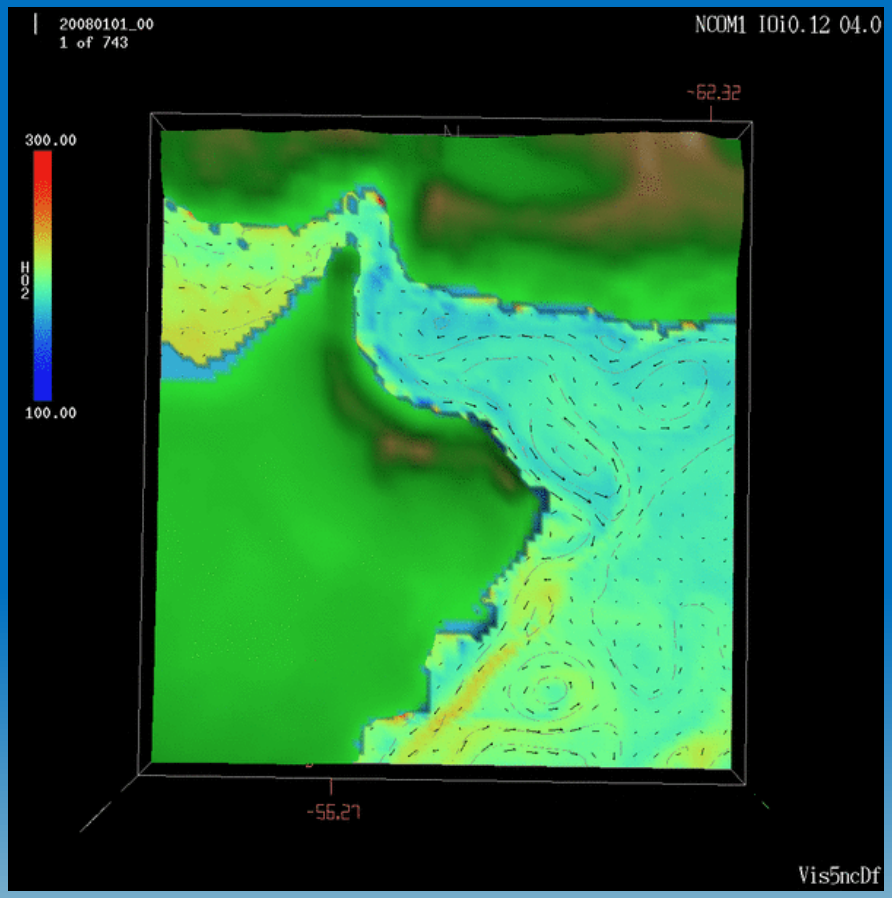
Information Flow in DISCO Coastal Support System



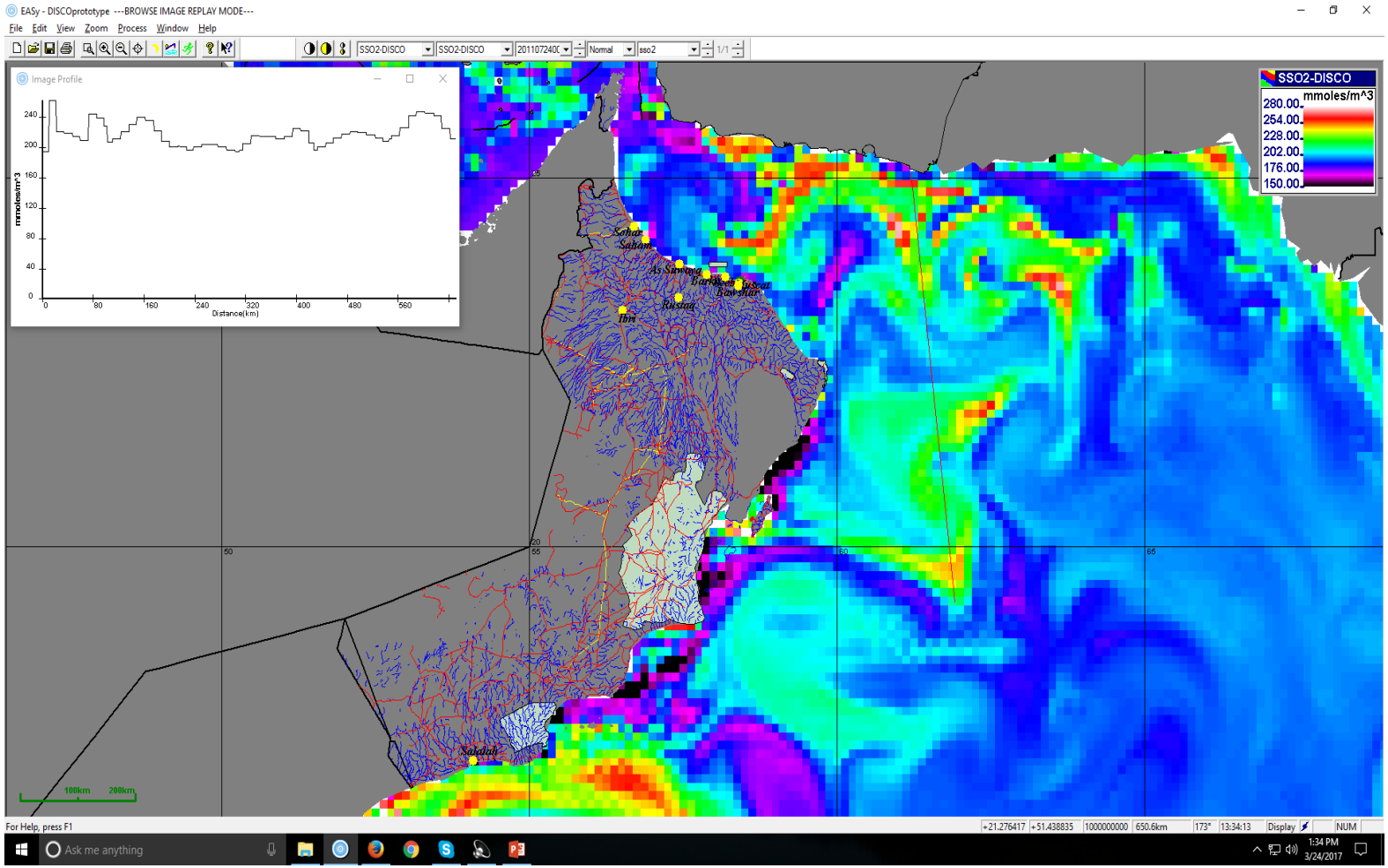
Nitrate



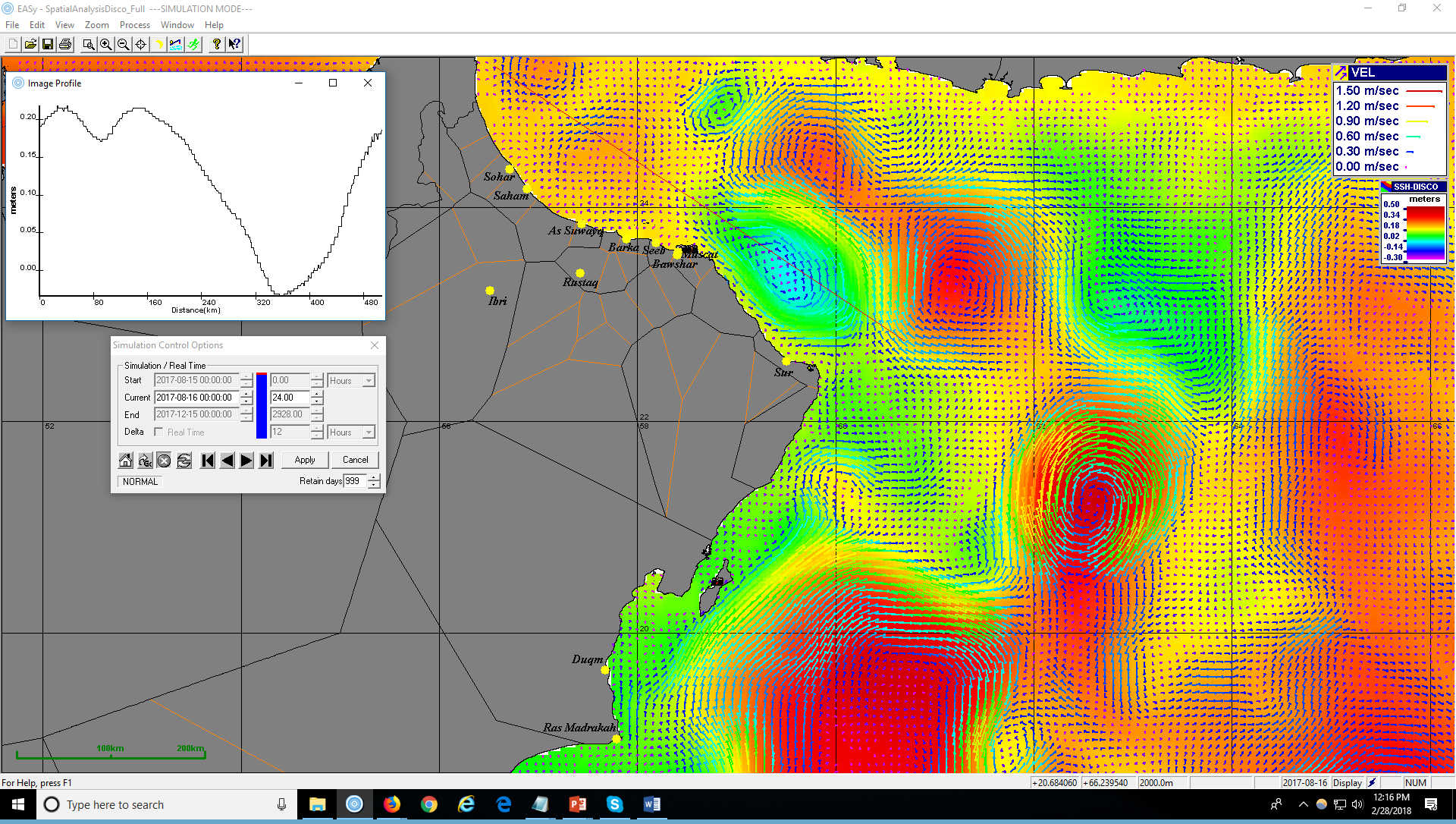
Oxygen



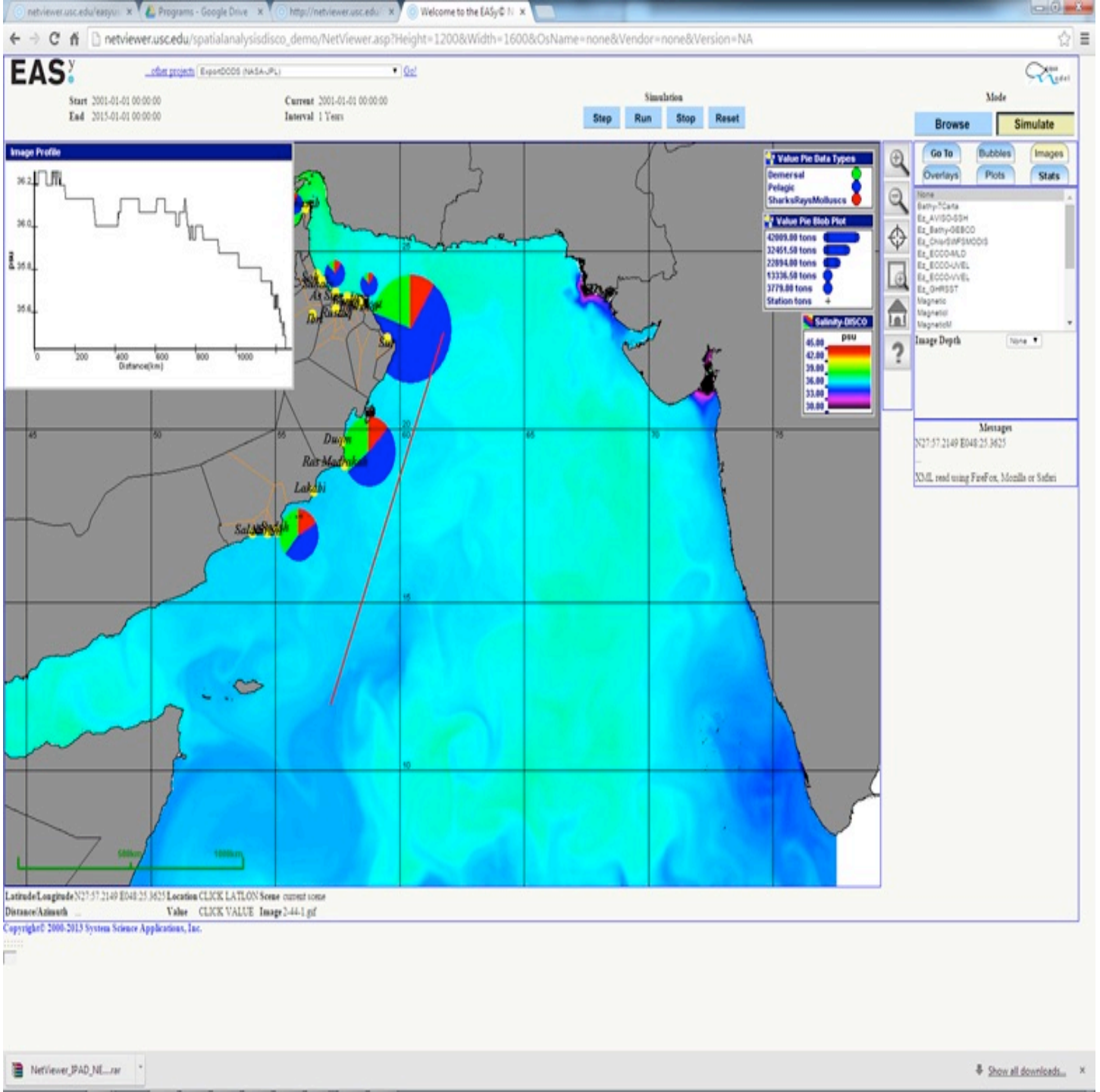
Nitrate and oxygen concentrations from NCOM-COSiNE model



NCOM/COSINE simulated sea surface oxygen (mmoles/m^3)



SpatialAnalysisDISCO: Spatial Analysis plugin used for the Oman DISCO project. Image shows NCOM-COSINE model output for ocean currents overlaid on sea surface height, along with a profile plot of SSH along the red line transect.


netviewer.usc.edu/spatialanalysisdisco_demo/NetViewer.asp?Height=1200&Width=1600&OsName=none&Vendor=none&Version=NA
EASy
Start 2001-01-01 00:00:00
End 2015-01-01 00:00:00
Current 2001-01-01 00:00:00
Interval 1 Years
Simulation
Step
Run
Stop
Reset
Mode
Browse
Simulate
Image Profile
Value Pie Data Types
Demersal
Pelagic
SharksRaysMolluscs
Value Pie Blob Plot
42009.00 tons
32451.50 tons
22094.00 tons
13336.50 tons
3779.00 tons
Station tons
Salinity-DISCO
psu
Go To
Bubbles
Images
Overlays
Plots
Stats
Image Depth
Messages
Latitude/Longitude N27:57.2149 E048:25.3625 Location CLICK LATLON Scene current scene
Distance/Azimuth ... Value CLICK VALUE Image 2-44-1.gif
Copyright© 2000-2013 System Science Applications, Inc.

ACKNOWLEDGMENTS

We would like to thank NASA, USA, the Ministry of Agriculture and Fisheries Wealth, Oman, Sultanate Qaboos University, Oman and Sultan Qaboos Cultural Centre, Washington DC